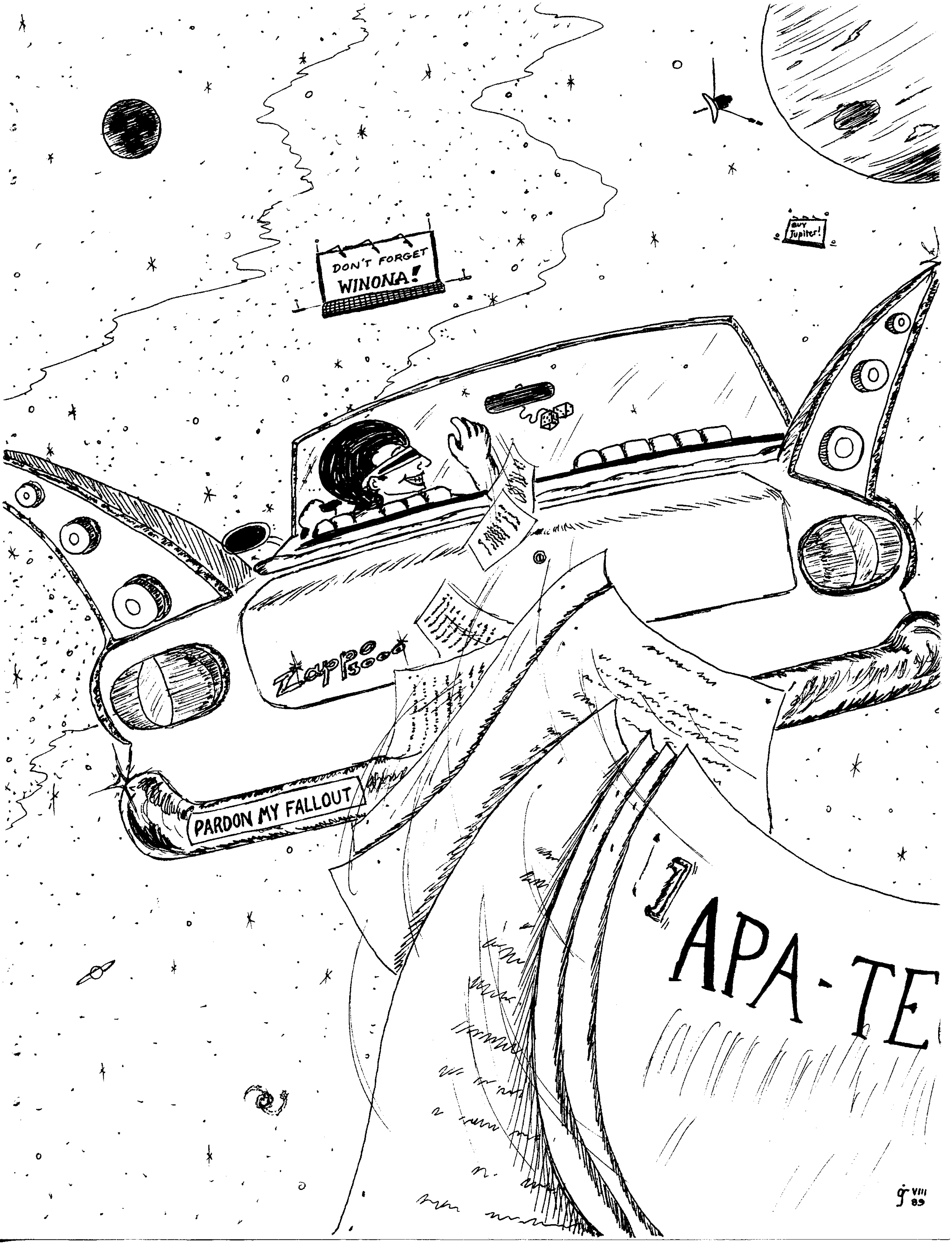
DON'T FORGET WINONA!
BUY Jupiter!
Zappo 5000
PARDON MY FALLOUT
1
APA-TE
VIII 89

AUGUST 1989 THE 555 TIMES

APA-TECH 66

The Amateur Press Association for General Technics
(the one with more oat bran)

G.T. Buckfast
+ Shalmaneser

Greg Ruffa, 1004 Seventh St., S.E., Apt. 103,
Minneapolis, Minn. 55414 (612)-379-9622

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page count: 33

Additions to APA-TECH 65:

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Houghton Berserker Announcement / Guy Wicker 3

total: 56

The minimum activity required is six pages per year (not including frankings); up to two covers a year may be counted toward "minac."

The copy count for the APA is twenty (20).

The deadline for APA-TECH 67 is Sunday, 1 October 1989.

Your postal account, prior to this mailing, stands at: $1.67

Either everyone is having a great time away on vacation or else you thought the deadline was next month. So this issue is a bit thin; perhaps we'll make up for it next time. One approach some folks told me they're going to try is just to write something when they have time and to send it in, ignoring the first-of-month deadline. Sounds fine to me...

Take care, all! Enjoy the rest of the summer and the Worldcon,

Shal.

APA-TECH Author Index
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	2 - Mike Sestak
	3 - Mike Bentley
	4 - Renee Sieber
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	6 - Dick Smith
7 - Rod Smith	
	8 - Steve Johnson
	9 - Bill Colsher
10 - (Tullio Proni)	
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63 - Annette Kavanaugh

CRUMBCRUNCHERS, INC.

P.O. Box 98
Ripley, OH 45167

The rain finally stopped, and summer decided to arrive. The full complement of vegetables never got planted, however, and now we've lost all our broccoli plants. Not to rabbits, no, but instead to whatever butterfly or moth it is that lays its eggs on broccoli. Regardless of who or what they are (I picked all the caterpillars off the plants - after they'd stripped them clean, of course - sigh), all we now have are broccoli skeletons. The other vegetables appear to be relatively pest-free, however.

Now that graduation is over, we no longer have school as an excuse for not communicating with people. However, as absent-minded as I am, I'd be sure to forget that I should write, and would miss a deadline again!

In the meantime, we've been doing summer-type things, like visit King's Island. The cost of admission to a large amusement park usually decides me against such visits, but as David said, it was approximately the same as what we'd spend eating at MacDonald's four times. (I DID get some change back from my two twenty dollar bills, and of course, we'd had a discount coupon.)

Visiting an amusement park with an almost-five-year-old means, of course, that a lot of rides are out of the question. So of course we didn't go on any of the roller coasters like King Cobra, the Vortex, or the Beast. We DID go on the roller coaster that's in Hanna-Barbera Land - a fairly mild roller coaster, but labeled by Marlene as definitely scary.

While going on some of these rides, I did discover some rather questionable things about myself - like I can recognize all the Smurfs! Argh!

We're in the process of acquiring (in pieces, of course) a Mac IICX. We're now trying to decide on the monitor, but hopefully we'll be up and running again soon. We'll probably be making a visit to Columbus one of these days to visit the MicroCenter, which is a computer "shopping center" you might like to take in if you're ever in Columbus.

Garage sales have been limited so far - most of my purchases ~~has~~ have been kids' clothes. Marlene now has more clothes than she'll ever be able to wear, and she'll probably have grown out of some of them before she does have a chance to wear them. (But 50¢ for a Polly Flinders dress is nothing to sneeze at - Polly Flinders being a "name label" in little girls' clothing.)

Summer's also a time for reading. I just received a news release from a library in Balitmore, MD, which detail how a group of teenagers had compiled a book list called "Youth to Youth Books: A List for Imagination and Survival." The categories in the list are: young adult realistic fiction, mystery/horror/suspense, adult fiction, science fiction/fantasy, and nonfiction. In the science fiction list, I discover a few that I've actually read. They are (in alphabetical order, of course!); Another Shore by Nancy Bond; Red Prophet by Orson Scott Card; Treason by Orson Scott Card; Merlin Dreams by Peter Dickinson; Tales of Robin Hood by

Clayton Emery ~~mery Clayton~~; Waiting for the Galactic Bus by Parke Godwin; Those Who Hunt the Night by Barbara Hambly; Dragonspawn by Anne McCaffrey; The White Raven by Diana L. Paxson; Lioness Rampant by Tamora Pierce; Starfire by Paul Preuss; The Duplicate by William Sleator; The Hex Witch of Seldom by Nancy Springer; Catspaw by Joan D. Vinge and Sister Light, Sister Dark by Jane Yolen.

Sister Light, Sister Dark was a book I had trouble "getting into."In many ways, it's fascinating, being interspersed with "commentary" by scholar/folklorists who inhabit the world/reality in which the story's set. But it seemed somewhat patchy, perhaps because it's the first book in a projected trilogy.

The Devil's Arithmetic, also by Jane Yolen, gave me no such problem. Being a "young adult" book, I could have read it at one sitting, it was so gripping. It's devastating also, but not really something you can put down. It is another book that falls into the science fiction category, being a "time travel" story.

A very brief synopsis of the story - the protagonist is a contemporary American Jewish teenager, at odds with her religion and heritage. During the Passover meal, which is at her grandparents' house, she is strangely transported back in time to an Eastern European shtetl. She and the shtetl residents are rounded up by the Nazis and transported to a death camp.

I happened to read the book the week before Passover began, so it was especially meaningful. The only disappointing thing was that, since I'd had to get the book through interlibrary loan, ~~and so~~ I had to return it fairly quickly.

Two books I just got for myself: Looking Good in Print - a Guide to Basic Design for Desktop Publishing and Ready-to-Use Layouts for Desktop Design. They just arrived yesterday, so I have yet to read them. Along the same lines, I noticed an ad in SMALL PRESS for a "template program" that uses either ReadySet Go or PageMaker, which provides a standardized format for books, magazines, etc. Something like this might come in handy for some of the things I do, like program books (though I'd like to see it before I buy it!).

Another neat book that you've probably seen in WaldenBooks: KidsCooking, which is, I think, put out by the same people who did Juggling for the Complete Klutz. It has lots of pictures, so you don't need reading skills to figure out the ingredients you need. (They couldn't figure out how to convey the directions for making things without using words, though, so a nonreader still needs the help of a reader to use the cookbook.) Occasionally a recipe will call for a "grown-up assistant" if, for example, some ingredient needs to be chopped up with a sharp knife, or something will be cooking in hot oil. So far, we've made "Better Burritos" (the most successful burritos I've had in my rather short career of burrito-making) and "Frozen Bananoids." (These are bananas, dipped in chocolate sauce, coconut and nuts, then frozen. We saw them at King's Island, billed as "Frozanas.") As I'm looking at the book right now, Marlene has come along to say that she'd like to make "Disgustingly Rich Brownies" so we may be going to have a baking session soon!

Since I've mentioned so many books already, I might as well mention some others I've just read and reread. These are all by Madeleine L'Engle. Three of these have been joined as "The Crosswicks Trilogy" (Crosswicks is her home in Connecticut, the house in A Wrinkle in Time and Meet the Austins): A Circle of Quiet, The Summer of the Great-Grandmother and The Irrational Season. In the first book, she examines her philosophy towards writing. The Summer of the Great-Grandmother is about death and dying, specifically about her mother's last summer. In The Irrational Season she explores her feelings about Christianity. My own feelings about Christianity are, of course, very different than hers. But I can't help but be awed by somebody who accepts Christianity, its beauties and mysteries so utterly, and who seems to have woven her faith so completely into her life.

Another neat thing about these books is that she has put herself so thoroughly into her books, talking about her childhood, her children, quoting from her journals. You can see her in so many characters in her novels - for example, Meg Murry - clumsy and near-sighted. I shared A Wrinkle in Time and The Summer of the Great-Grandmother with a friend, and he, looking at the photo of Madeleine in the back of the latter book, said that she looked much more like the description of Mrs. Murry, tall, willowy and all-knowing.

The final book by Madeleine L'Engle is Two-Part Invention, a memoir of her marriage with Hugh Franklin, who died in 1988. In this book, she talks much more about the early years of her marriage than in any of the other books. She also, of course, discusses her writing and her religion.

Some of Madeleine L'Engle's books that I've read recently have struck me as somewhat flawed and to me, vaguely dissatisfying. It's as if she is trying to capture the spirit and essence of A Wrinkle in Time , and not quite being able to find it. The Austin family novels don't have this problem so much, although A Ring of Endless Light seemed to have trouble resolving itself.

One of the most sobering things to come to me after reading all these books is that Madeleine L'Engle will soon be 70. (Although she never mentions specific dates in any of the books, I'm fairly certain that she was born in 1919.) It's easy for me to realize that Tolkien or A.A. Milne are dead, or that Isaac Asimov is approaching 70 himself. But to think of Madeleine L'Engle as an elderly writer....Of course, she was 40 before the books we most associate with her name were published.

Through the years I've revised my definition of what is old continually. It's moved upward and upward. I find it hard to think of my dad as old, although he'll be 70 in October, and my mom just turned 69. My grandmother, who is 99, finally fits my definition of old (after having been on an ageless plateau for at least 20 years). In fact, she refused to think of herself as old until fairly recently - she has squirreled away quite a bit in savings accounts in various banks, but when my dad suggested that she use some of her money for her own enjoyment and comfort, she protested, saying, "That money's for my old age." She was probably at least 85 when she made this remark, and my exasperated father said, "If you're not old now, I don't know when you will be!"

Weasel rats are a phenomenon I'm familiar with, though they've never gotten me personally. I've been warned about them in a magazine writing course I took at Ohio State. Since there's no way to copyright an idea, anybody you mention an idea for an article to considers that idea to be fair game. A variation of weasel rats occurs when you actually query a magazine with an idea, and an editor thinks it's a good idea. But instead of telling you the freelancer to go ahead, he/she assigns it to somebody on the magazine staff. And a few or several months later, it's quite possible that you may see an article in that magazine that looks suspiciously like your original idea. It doesn't seem fair that a magazine can steal ideas so blatantly, but there it is. (I think that it would be nice if they could at least offer you $5 or $10 as being the source of the inspiration!)

****

Is it possible that I will now write something that doesn't have to do with books?! We've just finished our July 4 holiday (which started on June 30!) and everybody is breathing a sigh of relief. Busy busy busy on all days, lots of selling of Pepsi and food, frying pork tenderloin and French fries, hawking raffle tickets, etc.

Marlene and I worked in the Pepsi booth for three hours straight on June 30 - something that she really enjoys doing. She likes asking people what they'd like (if they say "Pepsi"she wants to know "Real Pepsi?" - diet, of course, being a rather pale imitation!), scooping up the ice in the cups, and filling them. My only job is taking money and making change!

It was a real pleasure watching fireworks with MR this year - I never heard such appreciative noises from anybody. They had the fireworks set up on the Kentucky shore directly across from Ripley (there is no town directly across the river from Ripley, and the view was spectacular). Though they never set off more than two or three fireworks at a time, and never had a finale that was obviously such, the show lasted for 45 minutes.

There was actually a parade this year, albeit a small one. (Having a parade necessitates somebody to organize it, and lately, nobody has been interested.) I was asked to judge the entries, which was a challenge, as there were very few decorated entries, beyond a few trucks carrying the Girl Scouts, cheerleaders, girls' softball team, etc. Therefore, the American Legion marchers placed first, and the Girl Scouts third. The second place winner struck me because it was so unique - it was an ancient Chevrolet truck decorated up with lots of information about "the Association of Ripleys U.S.A." This is a one-man club dreamed up by the truck's owner, who has written to all the Ripleys throughout the country and collected interesting memorabilia from each. Several of these Ripleys were named after a Eleazer Whitlock Ripley, a War of 1812 hero. (I suppose somebody who lives in one of the many Rochesters or Columbuses has a similar hobby)

Our own entry I disqualified, since I was one of the judges; it wasn't very inspired, anyway -we just did it for fun. We decorated our wooden wagon with red, white and blue streamers, and mounted a dinner bell in the wagon. The bell was painted to (sort of) represent the Liberty Bell, and as we pulled the wagon, it swung in its cradle and rang. (Thus fitting in with the parade's theme "Let Freedom Ring.") Marlene was supposed to ring the bell, but she absolutely refused, and halfway through the parade route, said she was tired, so we had to stop while she climbed into the wagon. But on the whole, everything was very nice.

****

Since it's only July 6 as I'm writing this, there hasn't been time for any other exciting, interesting or disastrous things to happen to us, I guess it's time to get on to Mailing Comments.

VALLI: Well, as you can see, I'm back to using the typewriter! Hopefully this is only temporary, though in some ways I almost prefer it, because the hard copy is there immediately. We DID get a modem, but alas, it and the Tandy refused to cooperate (this was in pre-Mac days). So you can see that our electronic status is only semi-sophisticated. I HAVE read of people who have faxes in their homes, along with bitter complaints about the complications the machines cause. (These, of course, are people with home-based businesses!)

I would be willing to bet that people produce more waste paper using a computer than they would with no computer. I know we do! We sometimes print out one thing five or six times, trying to get it just right, whereas if we'd been using a typewriter, pen and ink or whatever, we'd have only had one chance. (I must have printed four or five versions of Dave's paper, which when completed, was 50+ pages.)

Your essay on roads not taken is quite poignant. Makes me think, at age 36, about where I am now, and where I thought I'd be fifteen years ago, when I graduated from college. I anticipated then something like working in a research lab, or possibly, when wearing my naturalist's hat, teaching little kids at an outdoor education center.

GABE & AUDREY: Isn't it amazing the number of magazines a person manages to subscribe to (and never gets to read through?!;! Here's our list (so that you can compare it to yours). News: WALL STREET JOURNAL, TIME, INSIGHT. Computer: BCS UPDATE, THE ACTIVE WINDOW, MACUSER, MACWORLD, PERSONAL PUBLISHING. Writing and publishing: SMALL PRESS, SCAVENGER'S NEWSLETTER, HOUSEWIFE'S WRITERS FORUM (ugh, what a name, but actually a pretty decent newsletter). I guess that HOME OFFICE COMPUTING goes under the computer catagory. OHIO WRITER. Professional: HISTORY NEWS, HISTORY NEWS UPDATE, NATIONAL BOARD BULLETIN. Another writing and publishing one: GUIDELINES NEWSLETTER. General: HARROWSMITH, COUNTRY WOMAN. Civic organizations: THE LION, GFWC CLUBWOMAN. Music: THE ORGAN PORTFOLIO, THE CHURCH PIANIST. And I;m sure there are some I've forgotten. Are we mad to think of possibly picking up NEW SCIENTIST again?! (At last glance, it was $115/year!) We will, of course, drop the WALL STREET JOURNAL, now that we can no longer get the student rate. We DO read NS, something that could never be said about the JOURNAL (bits and pieces, yes, but never a whole newspaper).

By today's standards, many 19th century upperclass Britishers could only be classified as bigots. I can still remember how shocked I was when I first read Kipling's "How the Leopard Got Its Spots" - when the leopard invited the Ethiopian to go into spots, he declined, saying that "black's good enough for a nigger." (My parents bent over backwards to make sure we didn't pick up the bigoted attitudes THEY'D gotten from their parents, but we didn't have any friends of other races, either, and until I was eight, we lived in a town with no black population - or Oriental or Jewish for that matter.)

ROD/ROXANNE: Re "archaic" Kentuckians (this applies to Southern Ohioans, too, at least the rural ones) - many do seem to be anachronisms - maybe it's their "Bible-Belt" upbringing, their stiff-necked Scotch-Irish ancestry? In a way, though, it's rather comfortable, because you can be relaxed about your speech patterns, and can use dialect words and phrases that would get a scowl from my English teacher mother. (Kids around here are often "onn'ry" and her can be used as the subject of a sentence, as in, "Her's growin' like a weed, isn't her?") And when it comes to religion, many of them really put their souls into it. Perhaps their faith is naive and unsophisticated, but it's DEFINITELY heartfelt.

ROD re AMAZING: I've read quite a few complaints about the new policy of not accepting unagented manuscripts. It seems that they're cutting off their nose to spite their face - it's unrealistic to expect a beginning author to have an agent. Aside from the fact that locating an agent might be difficult, a new author couldn't well afford one. With this policy, it would seem that they'll mostly showcase name authors, some of whom were probably first published in AMAZING when they were new (unagented) authors.

ROLF: Congrats on Ander's birth, and a big hi to him. Marlene too has lost two babysitters, and I have the feeling that the last one would have kicked Marlene out for being too obnoxious if she hadn't decided that she was tired of baby-sitting anyway. So for the last several weeks, the two of us have been trying to work our work schedules around one another. (I agree with Maria Montessori - what seems like "play" to adults is definitely "work" to a child.) We've been only semi-successful, but saying that I'm behind in my work because Ive lost a babysitter doesn't seem to hold much ice with people!

Thanks so much for the Martin Beck biblio! At least some of them have been reprinted in paperback (I found the paperbacks at World Wide News in Rochester, NY, a fascinating bookstore, as I've mentioned before).

****

I promised myself that I'd hold this down to six pages, despite the fact that I could go on for several pages more! So I'll close with brief movie reviews for the almost-five set.

STAR TREK V - One visit to restroom, one to water fountain. Mildly intersting.
INDIANA JONES - One water fountain visit. Holds attention fairly well.
BATMAN - "It's dark. I'm scared." Prolonged visits to restroom, water fountain and lobby. Definitely not.
HONEY, I SHRUNK THE KIDS - The hit of the summer. Lots of giggles, eyes on the screen almost the whole time, and NO restroom or water fountain visits. A definite yes. (We also had a four-year-old along - just barely four, and she liked it too.)

Susannah

IT CAME FROM THE FALSE VACUUM!

or

The Boy in the $SU(3) \times SU(2) \times U(1)$ Bubble

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* * *

I'm writing this from San Diego, as I've already begun my trip in Southern California. I was pretty busy at the minicomputer right up to the night before I left, since I wouldn't be getting anything else done there for two weeks; that pretty well left finishing the APA until now.

The night before I left, the 16th, was pretty exciting, between sorting out what I was going to take along, cleaning up the room, and running outside every twenty minutes to watch the lunar eclipse. The Moon was already about a third obscured by the time it was up high enough to see, but I did get to see the entire total phase. It was quite dark and almost reddish-brown through the first half of totality. The surprising part was that the eastern edge (or eastern limb, as astronomers call it) turned much lighter and yellowish during the last twenty minutes or so before the Moon started emerging into direct sunlight again (must have been pretty clear over Europe or something...). I'm starting to give thought to going to southern Baja California in July 1991 for the seven-minute total solar eclipse. The next total lunar eclipse we'll be able to see without having to travel is in (something like) 1993.

I got taken out to lunch by my old department at General Dynamics and got to talk to many of my former co-workers. I found out that the plant did open last August and is actively building Atlases and Centaurs. However, my old mission, Eutelsat-II, which we were hustling to have ready to launch in March of 1990, has been postponed indefinitely. The mission I was involved with before that, FLTSATCOM F-8, was the one where our ground crew forgot to disconnect something from the Centaur, backed the service platform away, and caused one of the tanks to rupture. After two years, we finally erected the Atlas/Centaur again, remounted the satellite, and prepared for a September launch. The rocket was struck by lightening and everyone is presently checking for electronic damage to the vehicle and spacecraft. Somebody up there HATES that mission!!

My department had about twenty-two people when I left a year ago and is now closer to forty, so there were a bunch of "kids" I didn't know who are now madly working on future missions, mostly for Atlas/Centaur. Business is good right now and we are planning for around nine launches a year out of two pads at Cape Canaveral by '92. Meanwhile, the Advanced Launch System is still flapping around: apparently the design *still* isn't "frozen" yet and the engineers keep having to tell the design managers that the thing is going to weigh a lot more and perform ~~more~~ much less effectively than the preliminary analyses suggest. Thanks to George Bush's lukewarm "endorsement" of lunar bases and manned Mars missions, NASA is funding an initiative to see if ALS can be used for those purposes. Looks like some more design changes in the wind...

After my visit with friends here, I am getting a ride up to Pasadena with a couple of my former co-workers to attend the Second International Conference on Solar System Exploration, being held at Caltech. (Of course, they, who work for a wealthy American corporation, will be staying in the Pasadena Hilton, while I will be splitting a room at the Travelodge with Higgins...) JPL is actively discouraging people from coming up *there*, so almost all activities connected with the Neptune encounter are being held around Pasadena (most people will be watching the pictures come in on remote monitors). My technical committee sits on Friday, the 25th: it'll be interesting to see how much work gets done with everyone distracted by interplanetary television. (Our last meeting in Crystal City in May was interrupted by the Shuttle launch of Magellan — picture thirty astronomers running out of a conference room to lean over the mezzanine atrium railing, in order to see the TV over the lobby bar...) I'll be bumming around L.A. over the weekend with Bill until he flies home, then I go to the Holiday Inn to hear more people talk about space at the Division of Dynamical Astronomy meeting of the American Astronomical Society before *I* go home.

When I get back, I get to wrestle with our Sun workstations some more (which is how I got an electronic mail address). I am trying out a random number generator I wrote, which is in some way connected with the work I am trying to help out with on statistical measures of the clustering of galaxies. I hope to be up to a point where we will be trying out some interesting *new* ideas on this by the time classes start, around September 22nd.

What does the colophon *mean*? The contemporary theories about cosmology are heavily influenced by results and speculations in high-energy physics. The *really* early universe was a simple place with only one kind of physical force. When it expanded and cooled, it underwent something analogous to a phase transition (like the freezing of water, for example), which led to a transformation of some resident field energies into a new sort of form that we call "mass." "Gravity" became a type of force distinct from the original universal force. The cosmic structural background beforehand was in a state we call the "false vacuum": everything came from the false vacuum. As the universe continued to expand and cool down, further phase transitions occurred, leading to the breakdown of the former single force into gravity, the strong nuclear force, the weak nuclear force, and electromagnetism, with the appearance of the attendant quantum field "particles" that convey these forces (gravitons (?), gluons, W and Z bosons, and photons). The mathematical entity which theorists use to characterize the early single force (in its simplest imagined formulation) is called SU(5), for special unitary group relating to 5×5 matrices which describe transformations among the particles which existed at that time. The SU(5) universe, as it passed through the phase transitions, developed "pockets" or "bubbles" with a more complicated mathematical structure, colloquially known to particle physicists as SU(3) × SU(2) × U(1), which characterizes the forces we now know. Our whole Universe is thought to be one of these "bubbles."

The other note is easier to explain: Tenth Avenue, S.E., which passes by my apartment building, is ripped out for five blocks for work on sewer lines and cable ducts. I figure all that asphalt and concrete is off visiting a wheatfield in South Dakota...

Congratulations to early, now former, APA-TECHer Dr. Keith Thorne upon the receipt of his degree – it's been a long time coming... (I missed the thesis defense, as I was embroiled in a cosmology final exam at the time.)

Special Seminar:

" Precision Measurement of the Ξ° Lifetime and Decay Asymmetry"

Keith Thorne, University of Minnesota

Friday, June 9, 10 AM ----------Room 435 Physics

This is the public presentation and defense of the content of Keith Thorne's PhD thesis

* * *

MAILING COMMENTS

APA-TECH 63
(continued)

Guy C. Now that I've read your story again (since the first time you showed it to me at McKelvy House), I like it a bit better. The necessary exposition is handled well without its becoming intrusive. I'd like to see the ideas developed a bit more fully. The "action sequence" comes pretty late in the story and appears pretty abruptly ; at present, it doesn't feel like it quite fits into the story smoothly. (I was amused to find a juxtaposition with mention of Sondheim's *Into the Woods*...)

"Random number" generators turn out to be chaotic devices. The intent in producing one is to write a deterministic algorithm that "looks unpredictable." If you generate a sequence of numbers from a particular "seed" value and do that again with a consecutive value, the new sequence diverges rapidly from the first and quickly looks unrelated. Perhaps chaotic processes *are* "operationally" random ; that is to say, they are as close as we can get physically to the mathematical ideal of randomness.

I think the book you describe is *The Year 2000* by Hermann Kahn (*et al.*?) ; I really ought to read it before century's end* (I finished *1984* on 1 January 1984...). Contemporary analysts keep rediscovering trends that the folks at the Hudson Institute and elsewhere were aware of in 1965 (of course, they also have access to intelligence data most of us can't request). I can recall an article in the mid-to-late 1960s on the late 20th Century's "3½ Superpowers": the U.S., the U.S.S.R., Japan, and Western Europe. The parts of this I question now are whether Japan will decide to be a *political* superpower and whether "Western Europe" might not also include Poland, Czechoslovakia, Hungary, and Yugoslavia by 2000. You might like to look at *The Next 200 Years* by Kahn *et al.* (I might get around to reading *that* by 2180...)

The other book we were discussing is James Oberg's *Uncovering Soviet Disasters: Exploring the Limits of Glasnost*. It came out last year, but there is a review in a recent *Nature* (since it just appeared in Britain). The reviewer remarks that it seems a bit dated now, since the Soviet Union is now very forthcoming about its past. Nonetheless, Oberg offers many thorough discussions of a variety of accidents and catastrophes, many causing extensive environmental damage.

Rod Your mention of the "Space: 1889" game reminds me of a story idea Bill Leininger has. Noting one day on his Moon map that there is a crater called Reichenbach (sp?), he thought of transposing the (semi-) climactic battle between Holmes and Moriarity to the ramparts of said lunar feature. Soon he, Ben Burch, and other Chicago folk were working out the materials and design of a vintage 1890s Moonship...

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* Yes, I know that's actually 31 December 2000...

Annette The thing that annoyed me most about Steen's article is the extensive usage of the passive voice — "people aren't doing these things to other people, *forces* are causing *outcomes*." This is typical Educators' Language: "we don't ask students to think about and answer questions, we want to elicit a response, we want to achieve learning objectives." The educational reforms we Americans *claim* we desire won't come about until we believe just about *anybody* CAN LEARN just about *anything*, that "learnedness" is something to be VALUED (and not something to be displayed on TV game shows...), and we eliminate from "institutions of higher learning" the implicit academic snobbism that "professor" is BETTER than any other job in the world (particularly because you don't have to do anything for anybody else...).

It strikes me that most of the "Great Men" in various disciplines were "monsters," as you use the term – Mozart, for one, comes quickly to mind. It's amazing how much you can accomplish if you don't have to do your own laundry...

APA-TECH 64

Doug Welcome to the APA! I hope the vagaries of your job will give you the time to keep us abreast of your exploits. Tell us more about what it's like to live on a rig for five weeks.

Roxanne Welcome back! And thanks for putting me up while I was out there for the AIAA Meeting. If it is the case that you and Bruce moved in July, *please* send your new address...

Rod Edward Teller, back in the Fifties, said trying to contain plasma with magnetic fields is like trying to push all the water to one end of the bathtub with your fingers. The big problem is that the field lines produce convex projections of force, which you're trying to use to squeeze down on a gas. Compare this with the problem faced by Seth Neddermeyer and his team, who wanted to use explosives to compress a plutonium sphere in an atomic bomb. The answer was the explosive lens: somehow (CLASSIFIED) you produce converging, *concave* projections of force to crush the sphere from everywhere at once. Laser-induced (or "inertial-containment") comes closer to achieving this, but sufficient symmetry and proper timing appear difficult to arrange...

It struck me that one may not have to *solve* the plasma instability problems. We have airplanes nowadays, for instance, that are aerodynamically unstable, yet fly because an on-board computer constantly adjusts control surfaces against developing instabilities in the aircraft's motion. Perhaps sufficiently fast electronics (are ours fast *enough*?) can monitor the plasma and adjust the magnetic field to maintain a steady reaction in the plasma. It may sound a bit daunting to have a computer solve magnatohydrodynamic equations that quickly, but perhaps *that's* unnecessary, too. Maybe a neural network can learn to run the reactor (they can already learn to balance a broom on its end)!

Could you describe more fully what you mean by "sentience," "intelligence," and "chaotic" (as opposed to disorderly) thought patterns? I *can* think of many situations where thinking about a decision in a crisis lead to a worse result than following the "natural impulse."

Bill It sounds like there are a finite number of Weasel Rats prowling all over and that the likelihood of them making off with a particular idea of yours increases with the amount of time it spends in your head. Unburden your brain more often! I thought of your note of this subject when a quotation from some Roman writer (I didn't recognize the name and have forgotten it...) turned up in 'fortune' on the Sun workstation; it said, in effect, "a curse upon those who make my remarks before I do." (Did the Ancients suffer from "Comics' Lung"?) I've experienced the historical extremum of this, which I call the "Aristophanes Stole My Best Lines" Syndrome... I'm sorry for you that you missed your chance in *Air and Space*; are there other possible "markets" for your article?

I had some comments upon Lost Futures, but they've been in *my* head too long and have slipped away. I'll try to come back to this later.

The most incredible thing to *me* about Chelebi's story about Lagari Hosan is that either of them thought you'd reach "the highest heaven" on 64 *kilos* of gunpowder (much less 64 tonnes)...

Guy W. I've been enclosing frankings from *Nature* on the cold fusion "furori" (as the Brits say). Even if this turns out *not* to be nuclear fusion (it's *not* just *cold*, it's virtually *radiationless*!), it'll still be interesting if it *also* turns out not to be electrolysis... In any case, pl*ease* don't blow up Michigan.

Donna Welcome back and congratulations upon your receipt of your Crime Prevention Award!

Do you have accounting records for other people who have had APA-TECH accounts, but have been inactive for some time? I've had inquiries from people who would like to rejoin, but I have no idea if we still have any money of theirs.

APA-TECH 65
(start)

Valli It was a bit chilling to read an article in *TV Guide* (while I was visiting my folks in June) to discover that Elinor Donahue and the other "kids" in *Father Knows Best* are now in their fifties! Good gravy, that means I'm –

Yes, we *do* enjoy your travel stories and would like to hear more about life in Europe. (We have all these people who travel overseas and we wish they'd tell us more...)

An all-electronic APA would shut out at least half of the people presently in *this* one. However, I am *now* in a position to receive contributions by "e-mail." (Actually, that's easier for me to deal with than Macintosh diskettes, since I have an AMIGA...)

I had heard that European SF conventions are more literary than ours are, but then so were U.S. cons *circa* 1955...

Thank for the "Trib" article on European space efforts. It should be said, in fairness to the U.K., that the British Space Centre *wants* a bigger role in all this, but Mrs. Thatcher has other priorities...

* * *

I should be caught up next time. Here are the last of the cold fusion notes (at least, for now); one page got left out last issue and appears here. There's also a couple fun things. Take care and have a good Worldcon!!

What to say about cold fusion

Public interest in recent excitements is to be welcomed, especially if it does not turn to anger when attempts to replicate the observation of cold fusion fail — the most probable outcome.

FLEISCHMANN and Pons have done at least one great service for the common cause: they have kindled public curiosity in science to a degree unknown since the Apollo landings on the Moon. In the past few weeks, people thought by those about them to have a few scraps of inside knowledge have been quizzed about the smallest details of the experiments at the University of Utah — those first described in the *Wall Street Journal* and the *Financial Times* on 23 March and at a press conference at Salt Lake City later that same day. The social phenomenon is all the more remarkable because of the wide distribution of those who have a general understanding of nuclear fusion and of the reasons why its practical application would be important.

These impromptu conversations seem generally to be remarkably good-humoured. Those who want to know more, and who in particular ask "Do *you* think it's true?", seem not too much annoyed by the prospect of continued suspense. It is remarkable that so many people are willing to accept that experimental observations, and the inferences drawn from them, acquire validity only by replication. Has what used to be called "the scientific method" now become widely understood?

If so, much of the credit should go to the daily press, which has risen superbly to the challenge of cold fusion. The two financial newspapers that broke the news on 23 March did so in cautious language, making it plain that cold fusion was not then a proven reality, let alone a commercial source of limitless energy. Other daily newspapers have joined in with commendable zeal and sobriety. Inevitably, the US daily press, with its resources and self-discipline, has done best, but newspapers such as the London *Daily Telegraph*, with no great tradition in the field of science reporting, have been magnificent. Reporters have given full and coherent accounts of meetings as far apart as Sicily and Texas, have canvassed opinions with care and have also faithfully reflected the good humour of these hectic weeks.

The good humour may not persist if the experiments cannot be replicated but there are some grounds for optimism. Part of the reason why so many people are so interested seems to be the general delight that a couple of people in widely separated universities have used their own money to pull off a trick on which governments have lavished huge sums of money in the past 30 years, so far without result. So people may well be indulgent if the attempts to replicate cold fusion on the scale described by Fleischmann and Pons prove failures. "It was a brave venture", they may say, "What a pity it did not succeed!"

That would be the best outcome. It is also, of course, possible that the general reaction to the failure of attempts at replication will be more sour. The scientific community's reputation is vulnerable in several respects, not the least of which is that neither the Utah group nor the Brigham Young group (whose account of its work appears on page 737, this issue) had, before seeking publication, carried out the rudimentary control experiment of running their electrolytic cells with ordinary rather than heavy water.

A close friend who is a Soviet biologist, on the telephone from the United States last week, was indignant at this neglect. He is correct. How is this astonishing oversight to be explained to students repeatedly being drilled in the need that control experiments should be as conspicuous in the design of an investigation as those believed to display the phenomenon under study? And how should the neglect be explained to the world at large?

There is no convincing explanation, only extenuating circumstances. Self-imposed secrecy has evidently hampered the investigators, understandably buoyed up by their belief that they had discovered a remarkable new phenomenon and fearful that too much talk about it would give other bigger battalions a chance to steal a march on them. Yet it is unthinkable that, if the authors had felt able from the outset to stand in front of routine laboratory colloquia and give a full account of their work, the question "Have you tried it with ordinary water?" would not have been raised. This glaring lapse from accepted practice is another casualty of people's need to be first with reports of discovery and with the patents that follow.

More subtle doubts perplexing those seeking to replicate the experiments would have been exorcised in the same process. The Brigham Young group, for example, clearly explains how it has been necessary to estimate the number of neutrons emitted from its electrolytic cells by subtracting from its observations of neutrons the background measurements, but Dr John M. Carpenter (one of the referees of the article by Jones *et al.*) explains on page 711 that the background may fluctuate with time, which argues for the need for contemporaneous controls. Sadly, the neutron monitor is a special device, of which there is only one copy....

The Fleischmann and Pons experiments raise bigger questions, if only because the scale of the phenomenon they report is so much greater. Both groups report the detection of neutrons, but the Utah group (*J. Electroanalyt. Chem.* **261**, 301; 1989) requires that there should be 10^{12} fusion reactions a second (within an order of magnitude in either direction) to account for the rate at which heat is produced, while the Brigham Young group is talking of one fusion reaction every 100 seconds or so. But the Utah group has not yet dealt with the natural question whether the observed energy output is energy stored in the palladium electrodes during the preparation of the cell. Records of cell voltage and current for the full duration of each run would go some way to settle the question, but have not been produced.

So are the extenuating circumstances sufficient to avoid the conviction of the scientific community for irresponsibility? No doubt the general opinion will depend on the outcome of attempts at replication, but the community might wish that its reputation did not hang on such a narrow thread, especially because the likelihood of replication fades as the days go by.

So robust scepticism is the only wise view. There may be something in the Brigham Young phenomenon, but that requires careful confirmation. The Utah phenomenon is literally unsupported by the evidence, could be an artefact and, given its improbability, is most likely to be one.

Luckily, there are a few blessings to count. Theoreticians have zealously recalculated the fusion rate between deuterons in a molecule (now reduced by 10 orders of magnitude) and have shown that the fusion rate between protons and deuterons, against naive expectation, is likely to be six orders of magnitude greater still — but still no more than 10^{-54} per molecule of HD per second. A week or so ago, ingenious schemes for bringing bare hydrogen nuclei more closely together in the electron sea of a palladium lattice seemed to offer an escape from scepticism. But not for long, even if it is plain that metal hydrides are an even more interesting field of research than had been thought.

John Maddox

Cold fusion doubts and controls

Sir—Much premature excitement has been generated by the claims and counter-claims for induced cold fusion. There is apparently no consensus (*Nature* **338**, 616; 1989) on the central questions regarding the amount of excess heat produced, the evidence for nuclear reactions and the vexed question of whether the detection of reaction fragments could be consistent with the claims for excess heat generation.

For many years we have been investigating primordial nucleosynthesis in a hot Big-Bang cosmology. The measured abundances of the light isotopes of hydrogen, helium and lithium place stringent restrictions on a number of physical parameters and are sensitive to deuterium–deuterium reaction rates. We have investigated by how much these reaction rates can be increased by a single low-energy resonance, consistent with deuterium–deuterium laboratory data, without destroying the ability to provide a consistent description of primordial light-isotope abundances.

Armed with these maximum reaction rates, we can estimate the density of deuterium packing in the electrodes of one of the cold-fusion experiments in order to generate excess heat at the rate of watts, as reported in some experiments. Our result is 10^7 mol cm^{-3}. We conclude that more heat has been generated in the media coverage of this subject than by deuterium fusion in electrolytic cells.

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Sir—Fleischmann, Pons and Hawkins' claimed[1] detection of neutrons and tritium from a postulated d–d reaction is not yet supported by their account of the controls used to eliminate other sources of both neutrons and tritium. The control on neutron background reported in ref. 1 — a series of measurement with the deuterium-containing cell removed — is no control on neutrons arising from photodisintegration of deuterons or other materials in the cell by ambient γ-rays. Such a background could also be a problem with the reported neutron flux of Jones *et al.*[2]. A check on that background would be to determine whether the neutrons appeared and disappeared when the power to the electrochemical cell was switched on and off.

The tritium measurement is even more problematic; one must have controls against the possibility of neutron capture creating tritium by the reactions $D(n,\gamma)T$ and $^6Li(n,\alpha)T$. Because tritium decay cannot be turned off, supplementary experiments may be needed to show that tritium does not grow into a vessel freshly filled with tritium-free D and ^{6}Li by either of the postulated reactions. Tritium is also known to exchange quickly with other hydrogen isotopes, is widely used in commerce[3], and is a durable contaminant of laboratories which have been exposed to tritium in various forms.

Note that repetition of the experiments in refs 1 and 2 with deuterium replaced by hydrogen is not a control on the suggested sources of neutrons or tritium. A negative result with tritium-free hydrogen is therefore moot with respect to claims of cold fusion based on neutron or tritium detection in a D–^{6}Li mixture.

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1. Fleischmann, M., Pons, B. & Hawkins, M. *J. electroanalyt. Chem.* **261**, 301–308 (1989).
2. Jones, S.E. *et al. Nature* **338**, 737–740 (1989).
3. Moghissi, A.A. *et al.* (eds) *Radioactivity in Consumer Products* (US Nuclear Regulatory Commission, Washington, DC, 1978).

Radiolysis of water

Sir—Baverstock and Cundall[1] suggest that the energy imparted directly and locally by ionizing radiation to a DNA molecule may manifest itself as broken bonds at a distance because, between the time of energy deposition and bond breaking, the energy is converted to a soliton, which may comprise a wave of coupled vibrational and electronic excitation travelling along the molecule.

In an electron–nuclear double-resonance study[2] of the crystalline malonic acid–urea 1:1 adduct (again a hydrogen-bonded structure) irradiated at room temperature, a signal was observed which was ascribed to a solitonic wave. This wave is excited and sustained by the presence of double-well hydrogen bonds in the crystal. The crystal structure consists of planar layers held together by a complex network of hydrogen bonds within the bond planes.

If we extend these ideas from the one- and two-dimensional structures above to a three-dimensional case, the classic example of such a hydrogen-bonded structure is liquid water. The initial behaviour of water irradiated at room temperature exhibits certain anomalies[3], which defy explanation if we base our ideas about energy deposition from high-energy radiation on gas-phase interactions, because this approach takes insufficient account of liquid structure.

In particular, in the *ab initio* modelling of product yields, the stochastic method of kinetic calculations[4], when used in conjunction with a well-known method of deriving the distribution[5] in spur energy, requires (in an acid system) the unit radius for H or e^-_{aq} to be as low as 0.44 nm and to be 0.19 nm for OH, in order to obtain the observed results for $G(H_2)$ and $G(H_2O_2)$ (where $G(M)$ is the number of molecules of M formed per 100 eV of radiation energy absorbed). In contrast, the deterministic method requires more credible values of 2.3 and 0.75 nm, respectively[5]. This is partly because, for the more abundant smaller spur sizes, the stochastic method gives a greater ratio of combination for unlike relative to like pairs of radicals.

This difficulty would be mainly obviated if the typical entity decomposed by radiation were a group of five to six molecules[6], part of the 'flickering cluster' structure of liquid water[7], in which the secondary electrons in the lower part of the energy distribution (below, say, 50 eV) give rise to a solitonic wave whose energy could be dissipated in these clusters in non-dissociative processes, but in which higher electron energies would cause dissociation and ionization. Such a model would remove the proportionality previously assumed between the energy per spur and the number of ionizations per spur (taken, for example, to be 6 ionizations per 100 eV in ref. 5, or 12 radicals per 100 eV in ref. 4), irrespective of the amount of energy imparted. To obtain the correct average ionization yield (about one ion pair per 20 eV), the energy transferred in packets larger than a threshold level of about 50 eV would need to be more efficient in producing ionizations, but the use of this modified distribution in the number of ionizations per spur would then give results close to those for a set of uniform spurs of 5–6 ionizations per spur, for which the stochastic and deterministic models give similar results[8]. In addition, the resulting, more realistic, unit spur radii of 2.3 nm for aquated electrons and 0.75 nm for hydroxyl radicals would give rise to agreement between prediction and observation in the effects of scavengers and of linear energy transfer, and also in time-resolved studies[9,10] as there is reasonable agreement in all these areas when the deterministic method is used[3,6].

An alternative stochastic approach[11] is showing interesting possibilities in some of these areas, especially in predicting scavenger effects at early times and time-resolved yields of e^-_{aq} for fast electrons[9] and for 3-MeV protons[10] — but the role of normalization at 10 ps in the *ab initio* calculation of ref. 11 was not adequately discussed.

In cases where the first-order structure of the water is broken down, such as during high-temperature (300 °C) γ-radiolysis (A.J. Elliot *et al.*, personal communication) or for densely ionizing radiation at room temperature[12], more product formation is observed than can be accounted for by normal diffusion-controlled kinetics. This may be because the lower-energy secondary electrons

Double blow for cold nuclear fusion

- Harwell investigation stopped
- Los Alamos collaboration fails

Washington

Two negative announcements about cold fusion last week may prove particularly troublesome to Stanley Pons and Martin Fleischman, the researchers who set off the controversial debate with their claim on 23 February that a palladium electrode immersed in heavy water will produce large quantities of excess heat.

Dr David Williams, leader of a large team at the UK Atomic Energy Authority's Harwell laboratory in Britain which has been examining cold fusion since mid-February, and which had received help from Fleischmann in setting up its electrolytic cells, announced that the team had finally abandoned its experiments, having found no signs at all of anything unusual.

In the United States, officials at Los Alamos National Laboratory (LANL) let it be known that efforts to collaborate with Pons and the University of Utah had, after much negotiation, come to nothing The idea that LANL scientists should examine working cold fusion cells at the University of Utah was brought up by Pons at last month's congressional hearing on cold fusion in response to questions about the difficulty of reproducing the claimed results and the importance of verifying them.

But at a press conference following the special cold fusion session at the Los Angeles meeting of the Electrochemical Society (*Nature* **339**, 84; 1989), Pons said that the collaboration was "subject to the signing of agreements", and a spokesman for LANL said that lawyers from the University of Utah were being very careful not to lose their grip on patent and intellectual property rights.

By the time of the Santa Fe cold fusion meeting (*Nature* **339**, 325; 1989), James Brophy, vice-president for research at the University of Utah, said that legal problems had been overcome and that the collaboration could proceed once a timetable had been arranged with Pons. But then, according to Howard Menlove of LANL, the laboratory had indicated to Pons its readiness to proceed, but received no indication of when work might begin.

After some weeks, an official annoucement was made last week by LANL because it was felt that constant talk of a collaboration without there being scientific activity behind it could be misleading to observers of the cold fusion scene. Menlove says that LANL is still ready to participate if Pons wishes it.

The decision by scientists at Harwell to end their investigation of cold fusion was eventually made, after almost three months, because the laboratory could not continue to devote man-hours, money and material to the project. Ten scientists, led by Williams, had spent three months and £320,000 on the studies, which began in the middle of February, even before the now famous 23 March press conference at the University of Utah, when the cold fusion claim was made public.

Fleischmann, of the University of Southampton, is also a consultant to Harwell, and had consulted his colleagues there originally to ask for their assistance in looking for a flux of neutrons from an electrolytic cell. An experiment was set up with Fleischmann's help.

After 23 March, the Harwell effort grew, and Williams and his colleagues obtained from Johnson Matthey, suppliers of palladium to Pons and Fleischmann, samples of every kind of palladium the company could provide, as well as some items made to order.

Williams therefore feels that the Harwell experiments have covered every conceivable aspect of palladium metallurgy, a murky subject which has frequently been invoked as an explanation for the purported success of a few experiments amidst the failure of most. But the Harwell team has not been allowed access to any of the electrodes from Pons and Fleischmann's working cells, which are now apparently back with Johnson Matthey.

Fleischmann last visited Harwell shortly after Easter, but since then had stayed away in order that the experiments should be seen as entirely independent of the original cold fusion claims.

The Harwell group also tried titanium electrodes, as well as some heavy-electron alloys and a number of well studied hydrogen-storage compounds, all with negative results. The sensitivity of their neutron detectors was even enough to contradict the claims of low-level neutron emission which have been made by Steven Jones and his colleagues at Brigham Young University.

Although no new science has come out of the Harwell investigation, Williams says that the interdisciplinary collaboration was nevertheless rewarding. But he has formed "trenchant opinions" about the dampening effects of lawyers on scientific investigations, and worries also that this public failure of a "crazy idea" may make scientists generally more reluctant to discuss the crazy ideas which are an essential part of progress. **David Lindley**

US LAUNCH VEHICLES

Titan boosts space plan

Washington

THE successful launch of a Titan IV rocket by the US Air Force on 13 June, coinciding with the release by the National Aeronautics and Space Administration (NASA) of a new timetable for shuttle and other launches, marks the end of the period in which the US space programme has been rethought and reorganized in the aftermath of the Challenger accident. The availability to NASA and the Department of Defense of a range of unmanned rockets as well as the shuttle restores much of the flexibility lost when the shuttle was fixed on as the sole US launch vehicle.

The Titan IV, a 'stretched' version of earlier rockets in the series, is seen by the US military community, which had always been critical of dependence on the shuttle, as the workhorse of its launch fleet. The identity of the payload launched last week is classified, but has been widely reported to be an early-warning satellite, destined for geostationary orbit and capable of detecting the plumes of enemy missiles.

Also last week, NASA issued a revised manifest for shuttle and expendable launch-vehicle flights, and the Titan IV is included for the first time. It will be used to send off the comet rendezvous asteroid flyby mission (CRAF), which had not previously been allocated a firm launch slot. Although NASA made the decision to put CRAF on a Titan IV instead of the shuttle because it was confident of the new rocket's imminent availability, the issuing of the manifest at the same time as the Titan's maiden flight was coincidental; the US Air Force had made no prior announcement of the launch.

The Hubble Space Telescope (HST) loses a few months, and is now scheduled for launch in March 1990 instead of December this year. The earlier shuttle flight has been given over to a mission to recover the long duration exposure facility (LDEF), a satellite carrying 57 experiments which was put into orbit by the shuttle in 1984. If not recovered soon, LDEF will re-enter the atmosphere and burn up.

The HST has suffered incessant and frustrating rescheduling because, unlike planetary missions such as Magellan (successfully sent off to Venus last month) or CRAF, it does not need to be put into orbit at any special time. A novel feature of NASA's latest manifest, intended to ameliorate this problem, is the designation of six shuttle flight opportunities, starting in 1992, with no reserved payloads. This extra flexibility in planning should mean that isolated launch difficulties should not require wholesale revision of the manifest. **David Lindley**

End of cold fusion in sight

Although the evidence now accumulating does not prove that that original observations of cold fusion were mistaken, there seems no doubt that cold fusion will never be a commercial source of energy.

It seems the time has come to dismiss cold fusion as an illusion of the past four months or so. At the outset, on 23 February, the suggestion that deuterium nuclei can be made to fuse together at ordinary temperatures, if in exceptional circumstances, seemed a brave leap of the imagination. The article on page 29 of this issue by M. Gai *et al.* of Yale University is merely another nail in the coffin of the idea. The Yale group has done its best to replicate the conditions of the original experiments, but has failed to replicate their results. Similar outcomes have been reported from other laboratories. So what has been learned from these hectic months?

First, the negative results now being reported do not imply that the original observations by Stanley Pons and Martin Fleischmann at the University of Utah and by Stephen E. Jones and his colleagues at the Brigham Young University were grossly mistaken. Events may yet show that there are circumstances in which palladium electrodes in electrolytic cells emit pulses of neutrons just as they would if deuterium nuclei were fusing together; early this month, a group at the Los Alamos National Laboratory was wondering what to make of such an observation.

So far, all that is clear is that the original reports do not conceal a recipe for making large (Utah) or even modest (Brigham Young) amounts of power by deuterium fusion. For the many non-scientists who have been excited by the past few weeks, this will be a disappointment. By the same test, the managers of orthodox experiments intended to replicate what happens within the Sun will be relieved.

One striking feature of these events is that, even now, those who have been trying to replicate the original findings are remarkably good-humoured about the time and energy they have spent. Those concerned seem to have found it an inherently interesting exercise. It is not, after all, every day that they find themselves worrying about electrochemistry and nuclear physics at the same time. And it is interesting to have been reminded at first hand of the remarkable capacity of palladium and titanium to dissolve hydrogen, usually known only from books and journals. Moreover, the brief spell in April when it seemed as if cold fusion would permanently divide chemists and physicists has left no trace.

All of us, even bystanders, have also learned a great deal about the difficulty of counting absolute numbers of neutrons and of γ-rays. The argument between Richard Petrasso and his colleagues at MIT on the one hand and Pons and Fleishmann on the other about the γ-ray measurements have been for many people educative, to say the least. Petrasso and his colleagues (*Nature* **339**, 183; 1989) first complained of inconsistencies in the only published report by Pons and Fleischmann of their observations , were given an incomplete reply (*Nature* **339**, 667; 1989), but on that basis were able to argue (*Nature* **339**, 667; 1989) that the energy channels in the original equipment had probably been miscalibrated and that the energy spectrum is narrower than the resolution of the γ-ray detector would allow.

There is even doubt about the placing of the γ line purportedly resulting from neutron emission which has been variously reported as at 2.2 MeV and at 2.5 MeV. Pons and Fleischmann originally put it at 2.2 MeV, which is what would be expected if the γ-rays come from the conversion of neutrons in water. But now, in their reply to Petrasso, they say they could not have measured such a peak at such an energy, but that it is in any case at 2.5 MeV (which Petrasso disputes on calibration grounds). The best resolution of this dispute would be by independent measurement, but that seems unlikely while attempts to replicate the phenomenon as a whole are unsuccessful. Meanwhile, there will be many who consider the γ-ray signal to have been an artefact.

That point is nevertheless crucial to the unfolding of events after 23 February, when both *The Wall Street Journal* and *The Financial Times* published long accounts of what had been done at Utah and when the University of Utah held a press conference to tell the wider world. (*Nature* owes Pons and Fleischmann an apology for having reported that, on that occasion, they had said that their formal paper had been sent to this journal for publication.)

It is unthinkable that reports of the production of excess heat in such complicated electrochemical cells would, by itself, have been seriously regarded as proof of deuterium fusion. Only the measurement of nuclear particles and products, with the expected energy, could have commanded the interest since shown. Pons and Fleischmann now say that "as we have repeatedly pointed out, we are well aware of the deficiencies of these spectra", but there are no records of that reservation earlier than the meeting of the US Electrochemical Society at Los Angeles, by which time they had been sent (but may not have read) Petrasso's first draft of his complaint. This is a more serious retreat than they acknowledge.

None of this implies that Pons and Fleischmann have been anything but straightforward. Put yourself in their position if you believe otherwise. If, on 23 February, you had made such an arresting announcement that the whole world was agog, even picking up the telephone would probably engage you in a half-hour conversation with somebody you had never met. Your compelling interest, to gather more data, would be compromised by the inquisitiveness of people asking elementary questions about issues then, in your mind, settled. It is remarkable that Pons and Fleischmann, with all the pressure on them, should have been able to cover so much ground.

So how should they, in the contemporary argot, have played it? It is too easy to say that they should never have given the story of their doings to the financial newspapers, or have allowed a press conference to be held on their behalf. The conventional wisdom, that they should have sent an account of their work to a respectable science journal and then have put themselves in the hands of its referees and editors, is too bland. If people believe they have found a way of changing the world, why should they not tell the world what is in store in their own way?

But there are obvious dangers in such a course, of which the chief is that one may be mistaken. Ordinarily, there is no shame in that: people make mistakes all the time. Ordinarily, there are also colleagues to point to pitfalls in one's path, but potential sceptics may on this occasion have been denied access by the care with which the project was kept secret over five years. It is less easy to accept that one may afterwards be required to accept irksome conditions on how one practises research by an over-confident university; from about 24 February, Pons and Fleischmann might well have decided that they should put their responsibility to the scientific community before that to the organizer of their press conference. Even now, it would be interesting if they made their data generally available, whatever its correct interpretation. **John Maddox**

Upper limits on neutron and γ-ray emission from cold fusion

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Neutron and γ-ray emission from a variety of electrochemical cells (running continuously for up to two weeks) have been measured using a sensitive detection system with a very low background. Titanium alloy powder deuterided at room temperature and high pressure was also used for comparison. No statistically significant deviation from the background was observed in either γ-ray or neutron detectors. The estimated neutron flux in this experiment is at least a factor of 50 times smaller than that reported by Jones *et al.* and about one million times smaller than that reported by Fleischmann *et al.* The results suggest that a significant fraction of the observed neutron events are associated with cosmic rays.

IT has been suggested recently[1,2] that deuterium in hydride-forming metals (palladium and titanium) can undergo nuclear fusion at room temperatures to release heat, neutrons, tritium and helium. Deuterium was incorporated into the metal lattices by electrolytic charging in solutions of heavy water. The nuclear reactions between deuterium nuclei that are enegetically feasible (the 'open channels') are as follows:

$$d+d\rightarrow {}^3\mathrm{He}(0.817\ \mathrm{MeV})+n(2.452\ \mathrm{MeV}) \qquad (1)$$

$$d+d\rightarrow {}^3\mathrm{H}(1.008\ \mathrm{MeV})+p(3.025\ \mathrm{MeV}) \qquad (2)$$

$$d+d\rightarrow {}^4\mathrm{He}(0.076\ \mathrm{MeV})+\gamma(23.772\ \mathrm{MeV}) \qquad (3)$$

Reactions (1) and (2) take place at similar rates[3], as suggested by room-temperature muon-catalysed fusion in molecular hydrogen[1] whereas reaction (3) can be assumed to be 4 to 5 orders of magnitude slower. Nuclear-fusion events must be characterized by the production of the ionizing radiations listed above, as there is no known mechanism that inhibits their emission.

It has been suggested that interactions between protons and deuterons,

$$p+d\rightarrow {}^3\mathrm{He}(0.005\ \mathrm{MeV})+\gamma(5.488\ \mathrm{MeV}) \qquad (4)$$

could also take place (at a faster rate) in metals charged with deuterium (and hydrogen) from heavy water (refs 4, 5 and S. E. Koonin, personal communication). Even if the hydrogen content in heavy water is small, significant concentration of hydrogen in the metal can take place because the rate of hydrogen-ion reduction on the cathode surface is greater than that of deuterium ions by up to a factor of 13 (ref. 6), and the diffusion rate of deuterium in Pd is only a factor of 2 larger than that of hydrogen[7].

Jones *et al.*[1] reported that, in their cells, neutrons from reaction (1) are detected at a small average rate of 2 counts h^{-1} above background. In one experiment (run 6) they report a rate of 15 counts h^{-1} for neutrons of energy 2.5 ± 1 MeV. With neutron detection efficiency of 1% and using a Ti electrode of mass 3 g, they quote a cold fusion rate for $d+d$ of $\lambda_f\approx10^{-23}$ fusions per deuteron pair per second (ref. 1). Fleischmann *et al.*[2] estimated a larger neutron flux of 4×10^4 neutrons per second from a 15-g Pd rod, measured with a neutron dosimeter with a detection efficiency of 2.4×10^{-6}.

Here we report on a search for neutrons and γ-rays emitted during conjectured fusion of $d+d$ and $p+d$ in various metals into which deuterium has been incorporated ('deuterided' metals). Measurements were carried out with an array of low-background, high-sensitivity neutron detectors and two large high-efficiency NaI(Tl) γ-ray detectors. The contribution from

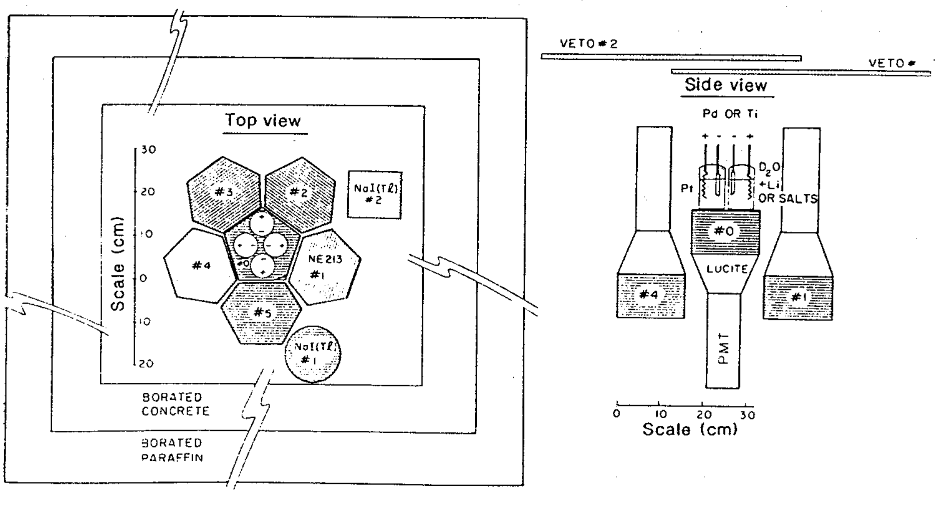

FIG. 1 Schematic diagram of the experimental setup, drawn to scale.

cosmic rays was measured with two large-area cosmic-ray veto counters. Four cells were used concurrently, with electrodes and solutions based on those used in the experiments reported by Jones *et al.*[1] and Fleischmann *et al.*[2]. In addition, one Ti alloy powder sample deuterided by gas-phase deuterium was used (see Table 1 footnote). We report here on data taken over a period of three weeks. We observe no statistically significant excess of counts of either neutrons or γ-rays above the background, and we have obtained upper limits on the rates of cold fusion in deuterided palladium and titanium.

The detector system

The neutron detector system is shown in Fig. 1. It consists of six NE213 liquid-scintillator neutron counters with fast-photomultiplier tubes selected from the Yale neutron ball[8]. Each detector was 10 cm thick. The central detector (number 0) was a regular pentagon (inscribed in a circle of radius 9 cm). The four electrolytic cells were placed on this detector with the palladium or titanium cathodes close to the centre, for maximum efficiency of neutron counting. The other five detectors (numbers 1 to 5) were irregular hexagons with dimensions similar to that of detector 0. These were arranged in a ring displaced 15 cm below detector 0.

State-of-the-art pulse-shape-discriminator electronic modules (ref. 9; modules produced by W. F. Piel) were used to distinguish between neutrons and γ-rays. A hardware gate was used to discard almost all detected γ-ray events in each detector. The efficiency of the neutron detectors was measured with calibrated neutron sources: ^{252}Cf (neutron energy $E_n = 2 \pm 1$ MeV) and Pu-Be ($E_n = 4 \pm 2$ MeV)[10] placed in the middle of the four cells above the centre of detector 0. The efficiency is sensitive to the value of the threshold, which was set at ~80-100 keV (electron equivalent), corresponding to neutron energies of 400-500 keV (ref. 11). The average efficiency of the detectors was measured as ~25% for neutrons from the ^{252}Cf source, in agreement with the value calculated from a simple model[11]. The efficiency of individual detectors ranged between 16% and 36%, reflecting individual thresholds and detector performance. The possibility that the detectors were only sensitive to the higher-energy neutron tail of the ^{252}Cf source can be excluded, as the spectrum includes less than 7% of neutrons with energies in excess of 2.5 MeV (ref. 10).

The detection of neutrons is characterized as a coincidence event between a primary neutron registered in detector 0 and a scattered neutron (with approximately half the energy of the primary neutron, as a result of detector geometry) detected in one of the detectors 1 to 5. A neutron event is then defined by measuring its pulse shape in the second detector, the pulse heights in the two detectors, and the time of flight between the two detectors, which is related to the energy of the neutron. The coincidence method significantly lowers the background in the detector system and at the same time yields a reasonable efficiency (discussed below). The time differences (t) between successive events in detector 0 and any one of the detectors 1 to 5, for neutrons from a Pu-Be neutron source, are shown in Fig. 2*a*, and from a ^{252}Cf neutron source in Fig. 2*b*. The raw data include γ-ray (γ-γ′) and neutron scattering events (n-n′). Gamma-ray-neutron coincidences (γ-n) are also evident in the spectrum. The γ-γ′ time resolution was measured, using standard γ-ray sources (^{60}Co, ^{133}Ba and ^{137}Cs), to be ~2.5 ns; an appreciable contribution to the observed time resolution comes from 'electronics walk' as a result of the low threshold. In Fig. 2*c* we show the time spectrum gated by the neutron pulse shape of detectors 1-5. We are clearly able to remove γ-γ′ coincidence events in the source data (these appear in Fig. 2*b*) by using this software gate on the pulse shape, without significantly affecting the n-n′ coincidence events. The time of flight between detectors whose centres are 20 cm apart can be estimated on the assumption that the scattered neutron emerges with 50% of the energy of the primary neutron. The value expected for a 1-MeV neutron (^{252}Cf source) is $\Delta t = 14$ ns and for a 2-MeV neutron (Pu-Be source) is $\Delta t = 10$ ns. These are in approximate agreement with the centroid separation of the n-n′ and γ-γ′ peaks shown in Fig. 2.

The total efficiency of the neutron detection system in n-n′ coincidence mode was measured using a ^{252}Cf source to be 1.0 ± 0.2% which is similar to that of Jones *et al.*[1]. Neutron-neutron coincidences from two primary neutrons from the ^{252}Cf source (emitting 3-4 neutrons per fission) are suppressed by a factor of 16 because of the small solid angle over which measurements are made, and thus do not affect our measured efficiency. This value of the efficiency is consistent with a solid angle of 30% of 4π for detector 0, a solid angle of 45% of 2π for the ring of detectors 1-5 and an average intrinsic efficiency of 25%

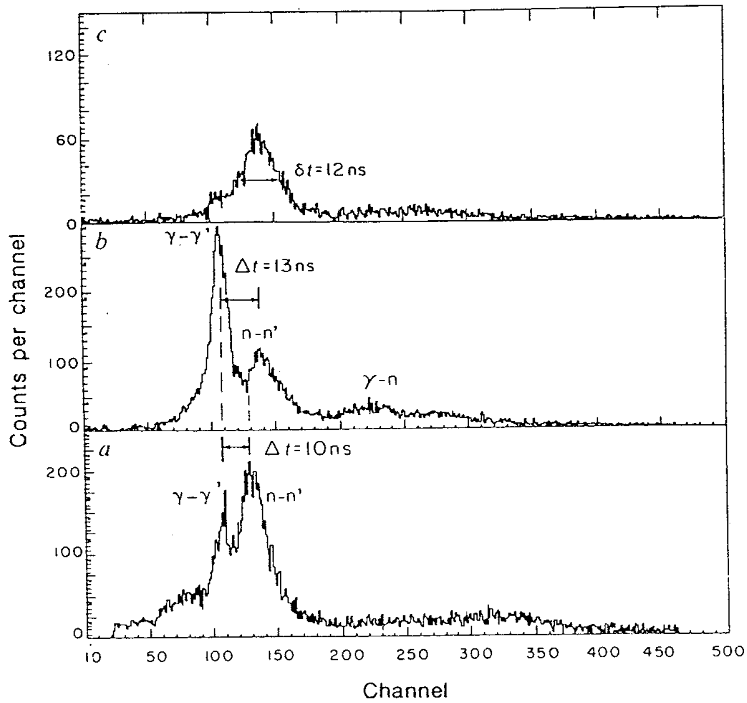

FIG. 2 Typical time-of-flight spectra measured with *a*, Pu-Be, and *b*, ^{252}Cf neutron sources, and *c*, with a cut on the neutron pulse shape, for the ^{252}Cf data. The time calibration is 2.5 channels per ns, with $t = 0$ defined at the location of the p-p′ peak. In *a* and *b*, Δt is the neutron time of flight. In *c*, δt is the width of the neutron time-of-flight distribution.

for the individual detectors. Calibration spectra were measured every 1-2 days to ensure that no drifts occurred in the system.

The neutron counting rate in each detector was ~120 counts h^{-1} over the entire energy range of the detector (for neutrons of energy <6 MeV). In the coincidence-time spectra the rates are less than 1 count h^{-1} in each pair of detectors and, on average, 1.6 counts h^{-1} in the entire array of all five pairs. All five time spectra between detectors 0 and 1-5 were summed at the end of each run. The neutron events are summed in a region extending from the γ-γ' peak (defining time of flight $t \approx 0$ ns) to $t = 40$ ns (that is, 100 channels beyond this peak). The latter boundary corresponds to the largest flight time possible for neutrons of lowest energy (400-500 keV, that is, just above the detection threshold).

Two large-volume 12.5×12.5 cm NaI(Tl) detectors, with a resolution of 7% at 1.33 MeV and total full-energy peak efficiency (for each detector) of 0.1% at 5.5 MeV, viewed the cells directly at a distance of 32 cm, as shown in Fig. 1. Two large-area, 6-mm-thick, plastic-scintillator veto-counters, with dimensions of 120×60 cm and placed 35 cm above detector 0, were used to detect energetic cosmic rays traversing the apparatus, with a veto gate extending for 3 μs. These detectors subtended an angle of ±60° above the samples, with a veto efficiency of about 65%. The veto efficiency was measured using the high-energy portion (31-MeV) of the NaI(Tl) spectra, as shown in Fig. 3. In this region the count-rate is due to cosmic-ray interactions and the veto efficiency is given by the ratio of the two rates (Fig. 3).

Data were collected event-by-event on a Concurrent 3230 computer and stored on tape for later analysis. Each recorded event includes up to 20 parameters. Pulse-shape and pulse-height data were recorded using two 8-channel ORTEC AD811 analog-to-digital converters, and time-of-flight data were recorded using an 8-channel LECROY 2228A time-to-digital converter. The data collected during runs 8-14 were accumulated using a CAMAC crate interfaced to an IBM PC/AT compatible (20 MHz) Dell 310 computer with histogramming capability only.

Data were taken in two-hour run periods which were recorded and examined individually before being summed. Background was measured under various conditions: with cells removed from the shielded area containing the detectors (run 2), with cells in their normal position but passing no current (run 5), and with a cell including heavy water and LiI salt without electrodes (run 4). This last cell was used to assess the effects of cosmic rays on cells that included material with a large atomic weight.

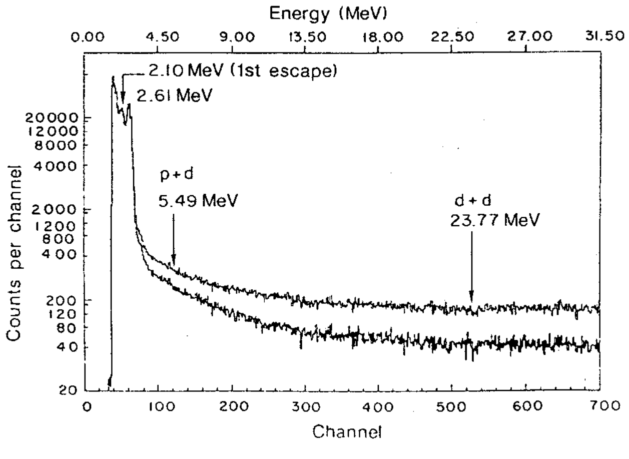

FIG. 3 Typical spectra from NaI(Tl) γ-ray detector 2 (run 6). The locations of the expected γ-rays from reactions listed in text are indicated. The raw γ-ray counts before and after vetoing on cosmic rays correspond to the upper and lower curves respectively.

The detector system was enclosed in a shielded housing of 15-cm-thick borated concrete and 15-cm-thick borated paraffin, and was covered with two layers of 15-cm-thick borated paraffin blocks. No lead shielding was used as this was found to increase the background. The housing's outer dimensions were 150×150×150 cm. The experiment was carried out in a target area of the A. W. Wright Nuclear Structure Laboratory (with the tandem accelerator not running) under a 90-cm-thick roof composed of steel-reinforced concrete.

In the following we outline the procedures used in applying cuts on the data. Run 7 contains data from cell number 1 (running for 15 days), cells 2-4 (running for 1-4 days), and sample 9 (see Table 1) on the detector. In Fig. 4*a* we show the raw data as registered in the first channel of the time-to-digital

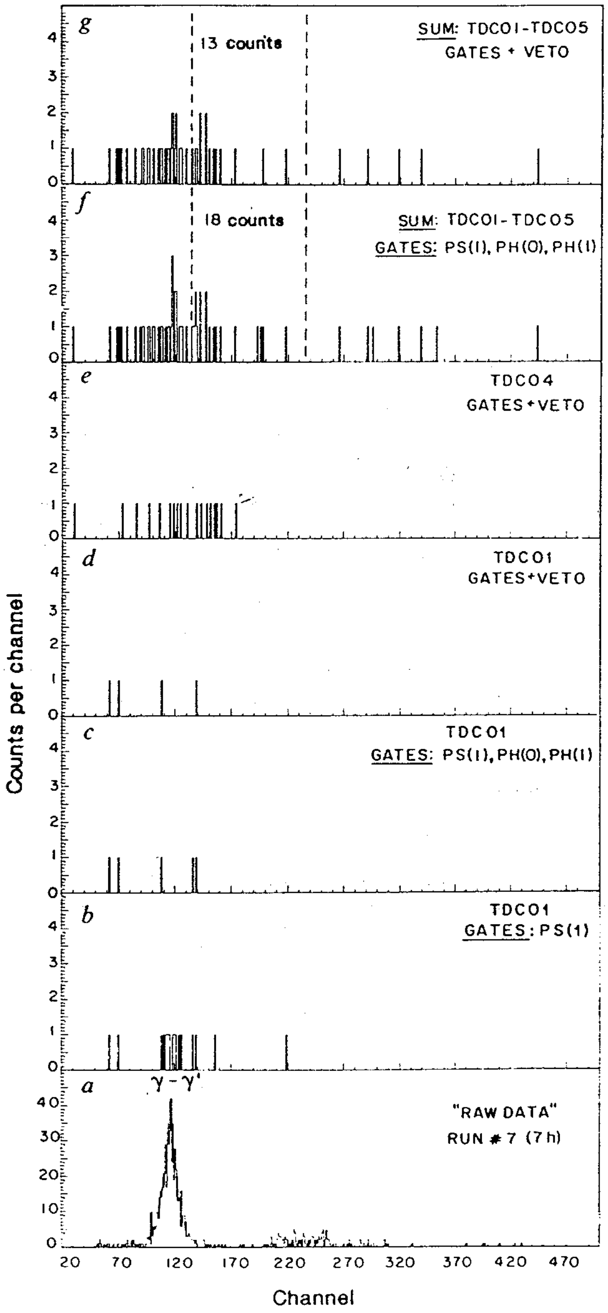

FIG. 4 Time spectra obtained during run 7 with cells on, with various gates and veto conditions as indicated, and discussed in text. The time range of interest, which brackets maximum and minimum times of flight of neutrons of about 2.5 MeV (discussed in text) is indicated by the vertical dashed lines.

TABLE 1 Measurements and elapsed times for charging electrodes (5–26 May 1989)

Run	Electrodes	Electrolytes	Charging time (h)	Counting time (h)
0*	1	3	up to 192	up to 60
	2	5	up to 72	up to 60
	5	3	up to 72	up to 60
	6	5	up to 72	up to 60
1	1	3	192	20.3
	3	1		20.3
	7	3		20.3
	2	4	24	20.3
2†	1	3	216	9.7
	3	1	24	9.7
	7	3	24	9.7
	2	4	47	9.7
3‡	1	3	226	15.3
	3	1	34	15.3
	7	3	34	15.3
	8	5		15.3
	9			
4§	None	10		6.1
5	4‖	2		11.9
6	1	3	270	
	3	1	78	
	7	3	78	
	4	2		28.6
7¶	1	3	299	7.0
	3	1	107	7.0
	7	3	107	7.0
	4	2	29	7.0
	9			
8#	1	3	346	10.0
	3	1	155	10.0
	7	3	155	10.0
	4	2	77	10.0
9	1	3	356	7.2
	3	1	165	7.2
	7	3	165	7.2
	4	2	87	7.2
10	1	3	364	17.3
	3	1	173	17.3
	7	3	173	17.3
	4	2	95	17.3
11	1	3	382	8.5
	3	1	191	8.5
	7	3	191	8.5
	4	2	113	8.5
12	1	3	391	11.9
	3	1	200	11.9
	7	3	200	11.9
	4	9	122	11.9
13**	1	3	411	23.5
	3	1	220	23.5
	7	3	220	23.5
	4	9	142	23.5
14	1	3	435	21.4
	3	1	244	21.4
	7	3	244	21.4
	4	9	166	21.4

ELECTRODES. **(1)** Pd plate 1 × 5 × 50 mm, cold-worked and heated in D_2 at 120 p.s.i. and 300 °C, and furnace-cooled under pressure (D/Pd = 0.73), immersed to 3.1 cm, (active area = 3.7 cm^2), anodized at 1 mA for 10 min. Electrical connections made with spot-welded Type 308 stainless steel rod, 3 mm in diameter. **(2)** Pd cylinder, 2 mm diameter, 100 mm long, annealed in flowing argon at 1,000 °C, immersed to 3.1 cm (active area = 1.9 cm^2), anodized at 1 mA for 10 min. **(3)** Pd cylinder, 6 mm diameter, 50 mm long, annealed in flowing argon at 1,000 °C, exposed to 120 p.s.i. D_2, anodized at 1 mA for 10 min., immersed to 3 cm (active area = 5.8 cm^2). Electrical connections as in (1). **(4)** Pd cylinder, 6 mm diameter, 50 mm long, with reduced section 2 mm diameter for electrical connection, annealed in vacuum at 900 °C, anodized at 50 mA for 10 min, immersed to 3 cm (active area = 5.8 cm^2). **(5)–(8)** Ti parallelepiped 3 × 3 × 45 mm, cold-worked, immersed 3 cm (active area = 2.8 cm^2). Electrical connections as in (1). **(9)** $TiFe_{0.7}Mn_{0.2}$ powder (43 g) hydrided at 120 p.s.i. D_2, at room temperature, charged on 19 December 1987 and recharged on 4 April 1989. Contained in a 2 cm × 20 cm cylinder. Etch for Ti: 5% HF (48%) in H_2O_2 (10 vol). Etch for Pd: 40% HNO_3 (98%): 60% HCl (36.5%).

ELECTROLYTES. **(1)** 0.1M LiOD/97.5% D_2O. **(2)** 0.1M LiOD/99.8% D_2O. **(3)** 1M LiOD/97.5% D_2O. **(4)** 1M ^{6}LiOD/97.5% D_2O. **(5)–(8)** 100 g 97.5% D_2O + 0.125 g $FeSO_4 \cdot 7H_2O$, 0.125 g $NiCl_2 \cdot 6H_2O$, 0.125 g $PdCl_2$, 0.125 g $Li_2SO_4 \cdot H_2O$, 0.125 g $Ti(SO_4)_2 \cdot 9H_2O$, 0.35 g $CaSO_4$, 0.11 g NaH_2PO_4, 0.125 g $CaCO_3$ adjusted to pH < 3 with HNO_3. **(9)** 0.1M LiOD/99.3% D_2O. **(10)** LiI solution (30 g) in 100 cm^3 heavy water. No electrode used.

* While experimental setup was improved, cells were on and counting was carried out with a reduced detector system. In this period five experiments were performed with the above electrode etched and abraded.

† Cells were moved out of shielded counting system, but cells remained on in a second, well shielded housing. Calibration measured.

‡ Cells were moved back into shielding together with sample 9, electrode 2 was replaced with 8. Calibration measured, cells on continuously.

§ Cells were run with electrodes 1, 3 and 7 outside of counting area. Calibration and background measured. Cells on continuously.

‖ Cell off.

¶ Three cells returned to counting area, together with sample 9. Calibration measured, cells on continuously.

# Counting system reduced to include only TAC01, PSD0 and NaI_2. Read by an IBM PC/AT compatible.

** Sample of heavy water (5 cm^3) was taken for analysis from cells 1 and 4.

converter (TDC01), corresponding to the time of flight between two detectors, measured between a (common) start signal from detector 0 and a stop signal from detector 1. In these data we again observe the γ-γ′ peak (defining time $t \approx 0$). Neutrons are expected in up to 100 channels beyond this peak, as discussed above. The background signal around channel 250 is due to the low threshold used in this experiment and arises from γ-γ′ events. By using a software gate on the neutron pulse shape of detector 1 such that only neutrons are detected in this detector, we get the data shown in Fig. 4*b*, and by excluding neutrons of energies larger than 3 MeV, we get the spectra shown in Fig. 4*c*. This yields a neutron detection rate in the 0–1 pair of 3 counts in 7 h (note that these counts cannot all be resolved by eye in Fig. 4). The cut on higher-energy neutrons removes n-n′ scattering events in the vicinity of the γ-γ′ peak ($t \approx 0$), because higher-energy neutrons are fast. By vetoing of cosmic-ray events we are left with 2 neutron events in the region of interest (corresponding to the largest and smallest possible flight times, and shown by dashed lines in Fig. 4*f*, *g*) after 7 h of counting in the 0–1 neutron detector pair (Fig. 4*d*). The 0–4 neutron-detector pair generally showed a higher counting rate (because of its larger measured efficiency), yielding 6 neutron events in 7 h (Fig. 4*e*). In the whole array, we obtained 13 counts for 2.5-MeV primary neutrons (Fig. 4*g*) in the area of interest, giving a neutron rate of 1.8 ± 0.4 counts h^{-1}.

Electrochemical procedures

The electrochemical cells used in this experiment were contained in 100-ml polyethylene bottles. The top of each bottle held the cathode (palladium or titanium, more than 99.9% pure), the anode (several strands of 0.5-mm-diameter platinum wire in an S-shape), a fine tube for the introduction of nitrogen gas presaturated with heavy water, and a vent hole for the nitrogen mixed with the gaseous electrolysis products. The flow rate of nitrogen through the cell was sufficient to dilute the deuterium gas to a concentration below 5%, thus reducing the risk of explosion.

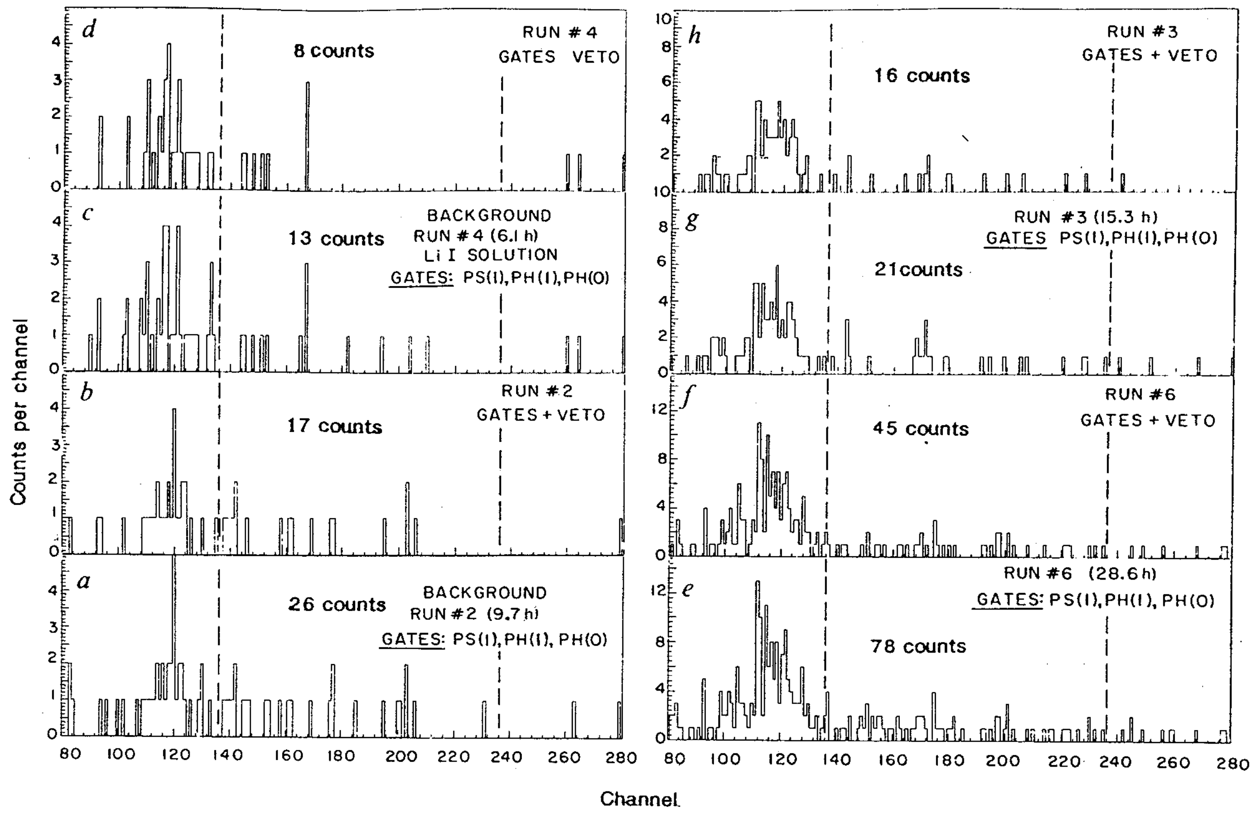

FIG. 5 Time-of-flight spectra obtained for various runs, both with cells on and off (background runs). The data in *g* were obtained under conditions similar to those in ref. 1. For further details, see text.

The connections, dimensions and pre-treatments of the palladium and titanium cathodes are listed in Table 1, and included etching and electrode treatments. Two types of electrolyte were used: LiOD (ref. 2) and a complex mixture of salts with an acidic pH, based on that used in ref. 1. LiOD solutions were made by adding lithium metal to D_2O. The compositions of the different solutions used, and the 'cell-on' and counting times, are listed in Table 1.

A constant current was provided by PAR 363 potentiostat-galvanostats. A current of 300 mA was used for all the cells except that including electrode 4, for which 500 mA was used. The cell voltages varied between 3 and 15 V, the higher values being found for electrolytes of low ionic strength. Heavy water was periodically added to the cells (a few cm^3 per day) to replace the heavy water lost through electrolysis. The H:D ratio in LiOD solutions was found by NMR techniques to be ~2.5% after one week of running time. One sample (9) of deuterided Ti alloy powder was used for comparison with the electrochemically charged cells. This powder sample was deuterided at room temperature rather than at low temperature, in contrast to the experiments of De Ninno *et al.*[12].

Results

Figure 5*a* shows background data measured over 9.7 h (run 2) with no cells in the shielded housing. This figure shows only the final gated and vetoed data, as discussed above. Data taken with only the solution of LiI salt (run 4) are shown in Fig. 5*c*. Background data with an uncharged cell in place and with electrode 4 in solution 2 (run 5) (not shown in Fig. 5) yield no statistically significant difference in the neutron rate. In Fig. 5*e* we show the results obtained by using one cell containing solution 2 with higher-purity heavy water (99.8%) in conjunction with the pre-treated electrode 4 (run 6). In Fig. 5*g* we show the data (run 3) obtained from cells and solutions similar to those used by Jones *et al.*[1] (see Tables 1 and 2). In Fig. 6 we show neutron count rates with background subtracted for all runs 1–14, spanning almost three weeks of data collection. Cells were charged for a few days before run 1 (see Table 1), and the neutron rates at that time were typically 1 ± 1.5 counts h^{-1} above background (not shown in Fig. 6). In several runs, we used solutions and electrodes with surface and chemical treatments similar to those used by Jones *et al.* Although in some respects

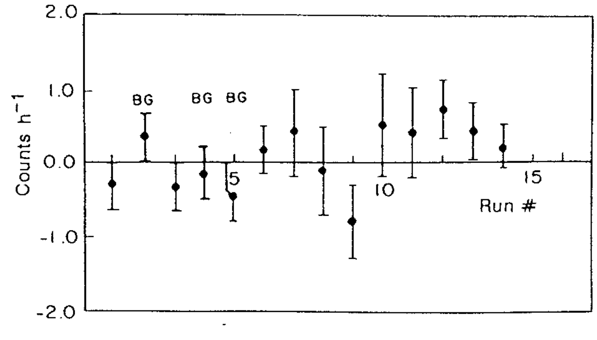

FIG. 6 Neutron count rates above average background rate (1.4 counts h^{-1}). The average rate is 0.1 ± 0.2 counts h^{-1} above background, which is significantly smaller than Jones *et al.*[1], who had the same measuring efficiency of 1%. BG indicates background runs.

our experimental arrangement may differ slightly from that of Jones *et al.* (for example, we used a platinum rather than gold electrode), the relevant features are similar. No statistically significant effect above background was observed. The average neutron count rate above background for run 6 is 0.1 ± 0.2 counts h^{-1}, a factor of 50–100 below the 15 counts h^{-1} reported by Jones *et al.*, who had a similar efficiency of 1%.

The vetoed neutron rates (at 2.5 MeV) are ~35% of the total detected neutron rate (Fig. 5). With the measured veto efficiency of 65% (Fig. 3), it is possible that the major portion of our neutron events (at least 50%) are induced by cosmic rays. However, as can be seen in Fig. 5, the same vetoed-event rates were observed with and without cells in the detection system, and hence it is not possible to attribute these events solely to the interaction of cosmic rays in the electrodes. We note only that cosmic rays yield neutrons of energies 1-3 MeV at a rate of ~1-2 counts h^{-1}. Our sensitivity would suggest that less than 10% of these neutrons are produced by interactions of cosmic rays in the cell alone. This rate (1-2 counts h^{-1}) is only slightly below the average rate (above background) of 2 counts h^{-1} reported by Jones *et al.*, measured at a higher altitude in Utah. In addition, the presence of a peak in the spectrum of cosmic neutrons with energies of a few MeV is well-known[13]. Although time variations of cosmic-ray distributions are small, it is still possible that variations in the effect of cosmic rays in the experimental arrangement of Jones *et al.*, or barometric changes[14], could account for the small effect that they reported.

These data can be used to set upper limits on d+d fusion. In particular, the data of run 6 (Fig. 5*f*) yielded 1.6 ± 0.2 counts h^{-1}. The average background rate (runs 2, 4 and 5) was 1.4 ± 0.2 counts h^{-1}. This yields an upper limit on the count rate resulting from the cells of 0.2 ± 0.3 counts h^{-1} above background, or a 3σ limit of 1.1 counts h^{-1}. The cell in run 6 (cell 4) includes electrode 4, consisting of 10.2 g Pd. With the assumption that the d : Pd ratio in the deuterided electrode is unity[15], our neutron efficiency (1%) yields an upper limit for the cold fusion of d+d in deuterided Pd metals (at 98% confidence) of $\lambda_f < 1 \times 10^{-24}$ fusions per atom pair per second. Run 3 includes a cell similar to that used by Jones *et al.*, with two Ti electrodes of mass 2.4 g (7 and 8; see Table 1). We obtain a rate of 1.0 ± 0.2 counts h^{-1} (-0.4 ± 0.4 counts h^{-1} above background) for this run. With the assumption that the titanium has been converted to the γ-TiD$_2$ structure with the ratio d : Ti = 2, this yields an upper limit on the d+d fusion in charged Ti (at 98% confidence) of $\lambda_f < 6 \times 10^{-25}$ fusions per atom pair per second. Summing runs 1, 3, 6 and 7 (spanning 71.2 h of counting), with a neutron rate of 1.3 ± 0.1 counts h^{-1} (-0.1 ± 0.2 counts h^{-1} above background), we arrive at an upper limit for d+d cold fusion in deuterided Pd and Ti (at 98% confidence) of

$$\lambda_f < 2 \times 10^{-25} \text{ fusions per atom pair per second} \qquad (5)$$

This rate is nearly two orders of magnitude below that suggested by Jones *et al.* ($\lambda_f \approx 10^{-23}$ fusions per deuteron pair per second). Similar limits were obtained in gases[16] for molecular HD ($<10^{-24}$ fusions per molecules per second) and for molecule D$_2$ ($<10^{-26}$ fusions per molecule per second).

The γ-ray data shown in Fig. 3, from run 6 extending over 28.6 h, with the total full-energy peak efficiency at 23.8 MeV of 0.02%, yield an upper limit on the emission of γ-rays from the fusion of d+d of $\lambda_f < 2 \times 10^{-20}$ fusions per atom pair per second; here we assume that reaction channel (3) has a branching ratio of 10^{-4}. The background at the range of interest (23.8 MeV) is ~1 count h^{-1} per channel and the energy resolution (full width at half maximum) at this region corresponds to 6 channels. The γ-ray rate at 5.5 MeV was measured in run 13 (at which time the residual activity in the detector from ^{24}Na, produced by successive neutron calibration, was small). With the cells that contain 2.5% normal water and with the separation factor of 13 (ref. 6) this leads to a ratio D : H = 3; here we have assumed that deuterium and hydrogen are distributed uniformly throughout the lattice. With the above assumptions and using the upper limit on the γ-ray count-rate above background (see Fig. 3), we arrive at the upper limit for the fusion of p+d (at 98% confidence) of

$$\lambda_f < 1 \times 10^{-22} \text{ fusions per atom pair per second} \qquad (6)$$

For a smaller separation factor of 4, the upper limit will be increased by a factor of 3.2. The p+d reaction rate of molecular hydrogen isotopes was calculated to be 10^8 times faster than the d+d reaction rate (refs 4, 5); in metals it is only 10^2 times faster (ref. 4 and S. E. Koonin, personal communication). Together with the d+d fusion rate suggested by Jones *et al.*[1], we would expect the p+d rate to be ~10^{-21} fusions per atom pair per second, a factor of 10 greater than our measured upper limit.

Conclusions

We have carried out a number of tests of some of the claims regarding cold fusion made by Fleischmann *et al.*[2] and Jones *et al.*[1]. We have attempted to reproduce the electrochemical conditions used by them, and have also used a sample deuterided under high-pressure gas. We have searched for the neutrons and γ-rays that must be emitted from the putative cold-fusion processes. Our experiments, with high sensitivity and small background, have revealed no statistically significant deviation from background. The upper limits that we deduce for the rates of cold fusion of d+d and p+d in metals are considerably smaller than those reported in refs 1 and 2. The average neutron detection rates above background reported by Jones *et al.*[1] (meausred with the same efficiency as here) are consistent with the rate that we measure for neutrons originating from cosmic rays. It is therefore likely that a significant fraction of the neutrons measured by Jones *et al.* may be attributed to cosmic rays. The absence of neutrons and γ-rays emitted from these cold-fusion systems, together with the absence of a known mechanism for the suppression of reactions (1), (3) and (4), raises serious doubts as to whether cold fusion does occur in deuterided Pd and Ti metals at the rates suggested by Fleischmann *et al.*[2] and Jones *et al.*[1]. □

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1. Jones S. E. *et al. Nature* **338**, 737-741 (1989).
2. Fleischmann, M., Pons, S. & Hawkins, M. *J. electroanalyt. Chem.* **261**, 301-308 (1989); and erratum.
3. Fiarman, S. & Meyerhof, W. E. *Nucl. Phys.* A **206**, 1-64 (1973).
4. Koonin, S. E. & Nauenberg, M. *Nature* **339**, 690-691 (1989).
5. Picker, H. S. *Nukleonika* **25**, 1491-1493 (1980).
6. Dandapani, B. & Fleischmann, M. *J. electroanalyt. Chem.* **39**, 323 (1972).
7. Wicke, E. & Brodowsky, H., in *Hydrogen in Metals II* (eds Alefeld, G. & Völkl, J.) 73 (Springer, Berlin, 1978).
8. Rugari, S. L. thesis, Yale Univ.
9. Pai, S., Piel, W. F. Jr, Fossan, D. B. & Maier, M. *Nucl. Instrum. Meth.* (in the press).
10. Hanson, A. O. in *Fast Neutron Physics* (eds Marion J B. & Fowler, J. L.) 3 (Interscience, New York, 1960)
11. Finckh, E. in *Nuclear Spectroscopy and Reactions* (ed. Cerny, J.) 573 (Academic Press, New York, 1974).
12. De Ninno, A. *et al. Europhys. Lett.* (submitted).
13. Hess, W. N., Patterson, H. W. & Wallace, R. *Phys. Rev.* **116**, 445-457 (1959).
14. Carpenter, J. M. *Nature* **338**, 711 (1989).
15. Hoare, J. P. & Schuldiner, S. *J. electrochem. Soc.* **102**, 485 (1955).
16. Champagne, A. E., Howard, A. J. & Parker, P. D. *Bull. Am. phys. Soc.* **26**, 564 (1981).

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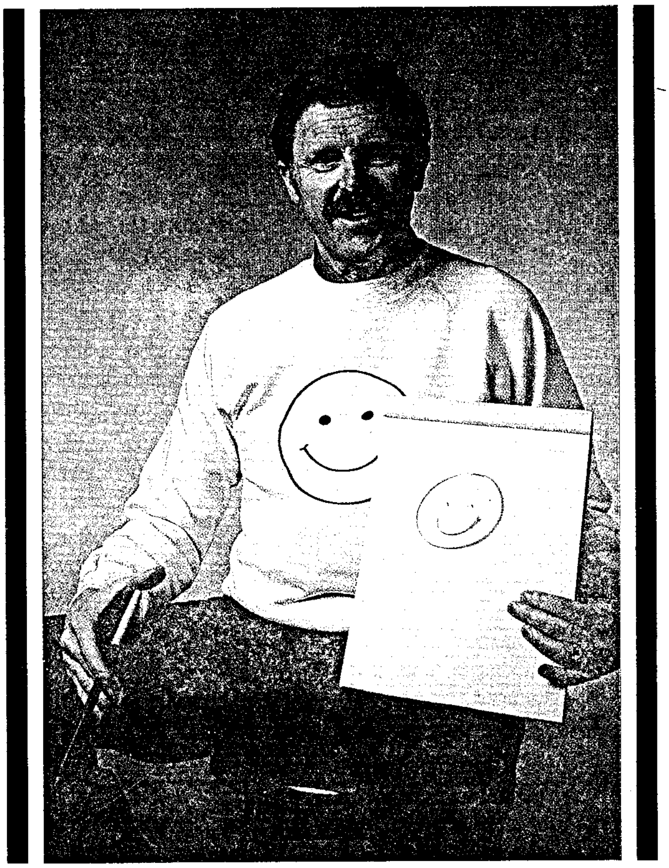
Loss of Face

By ADAM WOOG

■ An old friend is back. That 1970s symbol, bus-yellow and ubiquitous, of automatic niceness and thoughtless good will—yes, the smile button—has turned up once again. This time, however, it has transcended the realm of middle-class trinkets, lapel pins and refrigerator magnets and keychains and the like. It's real fashion now. Taking its cue from the huge London music/fashion trend of 1988 known as "acid house," the Smiley Face has taken up residence at European and American specialty boutiques and upscale department stores such as Bloomingdale's, which can't get enough of T-shirts and tote bags and cycling shorts featuring the little smirker. This is the latest, and perhaps the ultimate, example of popular culture's recent self-regurgitant tendencies.



CLIFF HOLLENBECK

David Stern is the guy who invented the smile button—and then forgot to copyright it.

David Stern looks on at act two of the Smiley Face story with less bitterness than you might imagine. Stern, you see, is the man who holds probably the most persuasive claim as the smile button's creator. The only problem was, he forgot to copyright it. And he's glad he forgot. "I'd have spent the rest of my life in litigation," he now figures. "My kids love to remind me that if I had just two cents for every time the thing was used, I'd be bigger than Donald Trump. But so what? I wouldn't have had time to watch those kids grow up."

First question: Was the Smiley Face actually created, or did it just emerge, full-blown, from the brow of the marketing world? Simple drawings of smiling faces are, of course, nothing new; generations of grade school teachers have stuck them on test papers, and what child hasn't scrawled one on a fogged-up car window? But we're not talking about that here, not really. We're talking about the world of licensing arrangements and royalties, the world of suppliers and distributors—in short, the world of business.

Even here, the smile button had its predecessors, most notably the "WMCA Good Guys" sweatshirts given out as a promotion by a New York radio station in the mid-1960s. (John Lennon's wearing one on a Beatle card.) Its invention has also been ascribed to an insurance company in the Northeast and a California media maven. But perhaps the most credible story regarding the origins of the button—which in turn led to the unleashing of that face around the world—belongs to Stern. The year is 1967, the unlikely venue Seattle.

In the turmoil of the era, the merchants of the city's University District were having a rough time of it. Local hippies littered and loitered and preached revolution; all this was not especially good for business. One establishment in particular, University Federal Savings & Loan, was unusually sensitive to

continued on page 78

continued from page 30

the tense sociopolitical climate—its office had been bombed once. There was a real need, the bank felt, to lift community spirits as well as to woo customers. With that in mind, the young ad man on the bank's account, David Stern, was charged with the task of creating a campaign with a double mission. He was to give the depressed neighborhood a lift, and also to portray University Federal as a concerned community institution.

Stern was mulling over various possibilities when luck and inspiration collided. It happened simply; he went to the movies to see Dick Van Dyke in *Bye Bye, Birdie* and left the theater humming the song "Put On a Happy Face." You can guess the rest. "It stuck in my head," he says. "I drew this little character and found a theme: 'Open a savings account and put on a happy face.' I had my art director clean the thing up, we made one button, and I put it on. That was the test marketing—me wearing it around. The question was, how many people would see it and smile? The answer was, a lot. I ordered 10,000 of the buttons and the bank put them out in bowls."

Reaction was immediate: The buttons were grabbed by the handful, and soon lapels all over Seattle sported beaming yellow faces. The bank was delighted by the campaign, Stern felt satisfied that he'd done a good job, and everyone was. . . well, *happy*. The first hint that the button was the start of an international cultural phenomenon didn't come until several months later, when an insurance company then headquartered across the street from the bank put out its annual report. Contained within the report was a reproduction of the button. "I was *not* very happy," Stern admits. "However, we were stuck. My client did business with the insurance company, so we couldn't upset them. I did tell the president that I thought they'd done wrong. His reaction, to quote the song, was, 'Que sera, sera.' I realized then that it was open season."

Indeed it was. Before long, Smiley Faces were blooming everywhere, millions of them, and Stern stood by helplessly because he had neglected to apply for the copyright. He still maintains there were perfectly good reasons for not doing so. "In advertising, you always come up with new ideas," he says. "You never know what's going to work. You're too busy to protect everything, and unless you're terribly vain, you can't believe that everything you do will cover the world."

> *There is no way of reckoning how much revenue the Smiley Face engendered during its original heyday.*

Although he contends that he doesn't regret the decision for an instant, he admits that if the insurance company had compensated him for using the face in its annual report, he might have considered taking steps to protect his little friend. But what if he had? Would copyright protection have nipped the face's popularity in the bud (assuming that its profit potential would not have been as attractive had manufacturers been forced to pay royalties), or would supermarket checkers smile at us today and say, "Have a nice day, copyright 1967 David Stern"?

This train of thought leads deep into the dark forest of intellectual property law. To be copyrighted, a work must pass federal standards of original authorship; the Smiley Face's simplicity and universality make it a questionable candidate. And even if Stern had succeeded in claiming it as an original creation, the number of legal challenges to his claim would have been overwhelming.

Not only that, enforcement would have been extremely difficult; lawsuits might have discouraged early rip-offs, but successfully defending the copyright would probably have ultimately halted the face's worldwide spread. As it is, there is no way of reckoning how much revenue the Smiley Face engendered during its original heyday, apart from evoking the "billions and billions" made famous by that other celebrity of the 1970s, Dr. Carl Sagan.

The odd story of the Smiley revival began in January, 1988, as interest in a new brand of dance music—a spare, repetitive, spacey version of disco—stirred in London's fashionable club scene; the music was called "acid house," for complex and not entirely clear reasons. That month, the first acid house single to hit the British pop charts was a song called "Beat Dis" by Bomb the Bass—and its picture sleeve, for some reason, featured a Smiley Face. Instantly, the logo became the symbol for an entire fashion scene.

Within a couple of months, several "quick couture" companies had mapped out lines of clothing designed to cash in on acid house; one fashion firm called Pink Soda even referred to its line as Smileywear. Originally into Smiley Face merchandise for a relatively modest £15,000–20,000 ($24,000—

32,000), Pink Soda, seeing the acid house phenomenon gathering momentum with alarming speed, invested another £100,000 in more happy-faced gear. Britain's top mass-market boutiques such as Concept Man/Chelsea Girl and Miss Selfridge placed significant orders.

By September, acid house (and its grinning symbol) had made the national tabloids as the newest, hottest youth trend. A lot of people were primed to make a lot of money. Then, as the British music magazine *Q* put it, "someone in [the British press] realized that 'acid' could mean LSD, and it was discovered that the word 'Ecstasy,' which was to be seen on many a clubland reveler's T-shirt, might refer to a 'mind-blowing sex drug' rather than to the wearer's blissed-out state of mind. On October 19, the *Sun* reported on the 'EVIL OF ECSTASY'."

Never mind that at least in the beginning, drugs were at best a minor part of the acid house phenomenon. Just try to stop the British tabloid press when they get their teeth into something. Soon an unseverable connection between the music of acid house, the fashions, and illicit substances had been made, and the nation was mobilized. All acid house fashions—particularly the ones that featured the Smiley Face—became, for retailers, untouchable practically overnight, or at least by November. Most of the large orders were canceled. Pink Soda, reported *Q*, "like their competitors were looking to Europe again to complete their Smiley marketing on an upswing and offload superfluous stock." Worst of all, acid house died a death in clubland, and the new door policy all over London had one unbreakable rule: "No Smileys."

It's a long road that David Stern's creation has traveled, and heaven knows where it's headed. American graphic design historian Steven Heller—who calls the happy face "one of the most insidious tokens of American culture" ever created—doubts the symbol will have a lasting impact. "Symbols such as the cross have substance behind them," he argues, "but the abstract concept of 'happy' doesn't take you very far."

Cultural criticism, fashion, none of it matters to David Stern. The Smiley Face wasn't ever intended to prevail through the ages. Nor was it designed to make anybody rich, or hip. It was only supposed to make people happy. And despite its ups and downs, in its own peculiar way, it has succeeded. ☐

Adam Woog writes about business and culture for a number of American publications.

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What Happened to the Burma-Shave Signs?

By Richard and Joan Dunlop

Alexander Woollcott once remarked, "It's harder to pass up a Burma-Shave jingle than to eat just one peanut."

Yesterday's motorists knew from personal experience that Woollcott was right. The familiar, small red signs imprinted with two lines of rhythmic verse brightened many a cross-country drive. Most motorists agreed with the Burma-Shave poet who wrote, "'Twould be more fun—to go by air—if we could put—these signs up there."

Since 1926, when the first rash of them broke out along Minnesota roads, Burma-Shave signs had become established as legitimate Americana. During World War II, GI's took them overseas as nostalgic reminders of home. The late comedian Fred Allen entertained his listeners with an uproarious radio show entitled, "The Murder of the Burma-Shave Poet."

Today the only places one can find these engaging ads are in museums, including the Smithsonian. So whatever happened to remove them from our roadsides? Let's go back to the beginning.

It All Began

The story begins with a Minneapolis insurance man who early in life made enough money to spend the remainder of his years fishing. His name was Clinton Odell. He had built up the White and Odell Agency to the point where he could sell his interest and retire with impunity.

Into his serene retirement hustled his son Allan, back from college and bursting with business ambition. Odell Senior put up the financial backing, and Allan the energy to found a new company and market a new liniment "with zing to it." Unfortunately for the Odells, the American public was not interested. The Burma-Vita Company and its aromatic new product appeared doomed.

Then the company chemist told the Odells that he had developed a formula for a new shaving cream. It required no brush and had all the ingredients of success but one: The public didn't know about it. The first year's sales were negligible, and it appeared that the fledgling company now had two products dragging it down to ruin.

One day Allan was driving dolefully along a Minnesota highway when he spotted a unique series of signs advertising a nearby filling station.

"Cheer up face—," he found himself muttering, "the war is—over—Burma-Shave."

With Catchy Jingles

The elder Odell was willing to gamble $200 in lumber and paint to give his son's advertising notion a trial. Soon Minnesotans traveling on U.S. 65 near Lakeville were avidly reading the first Burma-Shave signs. Advertising men were quick to point out to the Odells that the signs were ridiculous. The only way to sell shaving cream was with statistics, testimonials and pictures of well-shaven, smiling faces in happy proximity to peach-smooth feminine cheeks.

Nevertheless, "Every shaver—now can snore—six more minutes—than before—by using—Burma-Shave," announced the signs as they spread into neighboring states. Allan and his younger brother, Leonard, were personally responsible for the distribution of the catchy jingles.

Leonard drove a truckload of fresh signs into virgin territory while Allan ranged ahead in a car until he found a good spot by the road. He looked for straightaways long enough for motorists to have a chance to read each word. Then he knocked at the door of the nearby farmhouse and dickered with the farmer for permission to put up the signs. When Leonard came grinding up with the truck, Allan would already have made the deal. The brothers broke out spades and dug holes for the sets of six signs. They planted them a uniform 100 feet apart.

As Leonard told the story, he was given a younger brother's privilege of doing most of the digging.

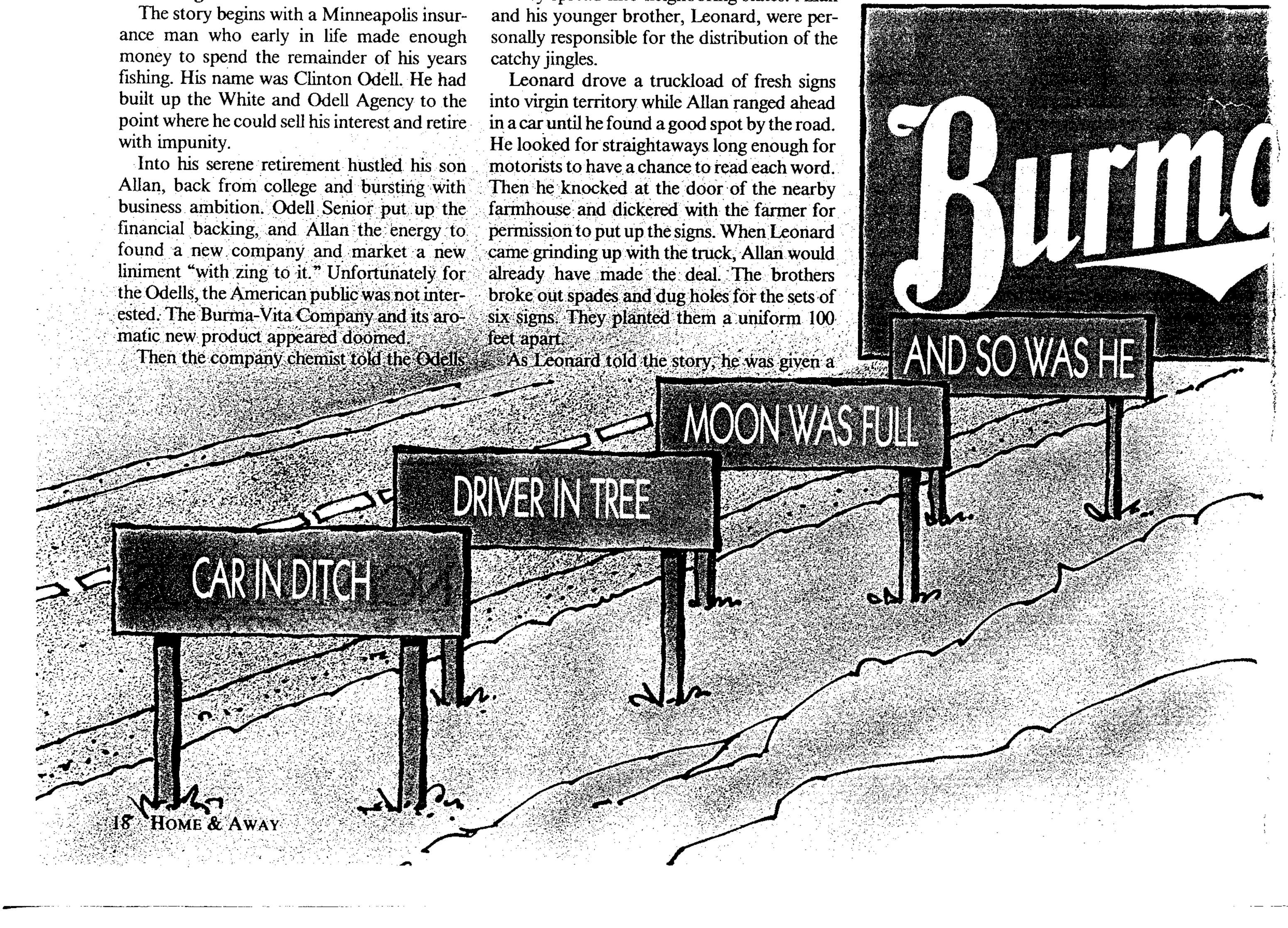
"I dug every hole for a sign in the Midwest," he remembered. "I learned the business from three feet under the ground and up."

Little Signs Along the Roads

The brothers ignored their blisters and kept on digging, and in the first year sales climbed from next to nothing to $68,000. First in the Midwest and then throughout the nation, Americans soon were reading, "Are your whiskers—when you wake—tougher than—a two-bit steak?"

At first Allan wrote all the jingles. Then, about the time friends observed that he was beginning to talk in Burma-Shave verse, he announced an annual national contest for bards of the open road. Soon the Odells found themselves reading 50,000 submissions to find the 20 new verses they would put up along the highways each year. Many of the jingles came addressed to B. Billious Rangoon, Sales Manager, the pseudonym with which Allan had signed one of the company's first magazine ads in the fledgling *New Yorker*.

Every spring in the years that followed, new rhymes burst into bloom along the road. Drivers ruefully rubbed their chins as they



read, "The answer to—a maiden's—prayer—is not a chin—of stubby hair." Wives gleefully chanted, "Does your husband—misbehave—grunt and grumble—rant and rave—shoot the brute some—Burma-Shave!" Husbands were rewarded on the next straightaway, where signs proclaimed, "Soon shaving brushes—will be trimmin'—those screwy hats—we see—on women."

Sales Climbed

Sales soared. They continued to climb right through the depression. Even in those dreary days, a man was apt to cheerfully plunk down a few coins for Burma-Shave after reading such happy messages as, "Special seats—reserved in Hades—for whiskered guys—who scratch—the ladies," or "No lady likes—to dance—or dine—accompanied by—a porcupine."

In the 1930s a national furor arose against billboards, which grew so rankly beside American roads. But the discrete little Burma-Shave signs went unscathed. Safety experts, in fact, chimed in with praise, pointing out that motorists slowed down to read them. Burma-Shave took the hint. Drivers soon read, "Don't take the curve—at 60 per—we hate to lose—a customer," or "Past a schoolhouse—take it slow—let the little—shavers—grow."

Allan Odell sent out other safety jingles too, but most of the bards wrote in the long tradition of exaggerated humor that reached its peak in the yarns of Abraham Lincoln and Mark Twain. Sometimes the humor backfired.

"Rip a fender—off your car—send it in—for a half-pound jar," advised a Burma-Shave bard. Within a few weeks of the appearance of these signs, the Odells received dozens of miniature fenders torn from toy automobiles. They chuckled at the tiny packages and told one another that the American public had a great sense of humor. Then the big stuff began to arrive, and their chuckles ceased. They received 25 crates containing real fenders. Stunned, Allan mailed the half-pound jars.

Another series of signs anticipated the space age with, "Free, free—a trip—to Mars—for 900 empty jars." Some years later a customer wrote and told B. Billious Rangoon that he had 898 jars saved up and would arrive soon in Minneapolis to take his trip into outer space. Odell hastily put on his discarded bard's cap and penned a new jingle, which was hurried onto the signboards. "If a trip to Mars—you'd earn—remember, friend—there's no return."

World War II found Burma-Shave-type signs blossoming overseas as GI's with week-old beards recalled their happy, smooth-shaven, state-side existence. Signs were erected along the Burma Road itself. In Italy the *Stars and Stripes*' "Yank about Italy" column quoted such examples as "A GI Joe—from Venafro—passed on a curve—now he's six feet below."

Till Interstates Took Away

In the early 1940s Burma-Vita built a new plant. It was a prototype of the one-story suburban factories that have proliferated outside American and Canadian cities in the years since. Situated on a tree-lined street in Minneapolis, it was surrounded by a public park. Instead of the $200 that the first year's signs cost, the Odells now spent over $100,000 annually to spread their inimitable verse throughout the nation, and increased the size of the signs by one-third.

But the times were changing. Urban growth with its accompanying suburban sprawl closed up the space once used for the sprightly little signs, and the proliferation of super highways lured drivers away from the slower country roads where the signs were still allowed. The company hit a seven-year plateau in a time of national expansion. They tended to reuse old rhymes and concentrated on hard sells, with a drop in the ratio of public service jingles. By the 1960s, the signs were costing $200,000 a year and were less effective. The company was experimenting with other methods of advertising: radio and TV.

Our Good Friend

In 1963 Philip Morris, Inc., bought Burma-Vita, and it became an operating division of a subsidiary, American Safety Razor Products. The new owners elected to gradually reduce the number of road signs, replacing them with other advertising media. They worried that the picturesquely fading relics would be the cause of more rent for farmers. Crews in trucks fanned across the country to unbolt signs and uproot posts, so that nothing remained of what had been. Farmers often seemed sad at the removal, not so much at the loss of income, but because, "It's sort of like losing an old friend."

There was plenty of publicity over the demise of the signs. The *Saturday Evening Post* and *Reader's Digest* both ran articles. The Advertising Club of New York held a luncheon to say farewell to the signs. The press noted that the Odells had "set off a wave of nostalgia" and that the "signs were having as many retirements as an aging opera star."

Burma-Shave

Leonard Odell presented to the Smithsonian a set of signs with the ironic message, "Shaving brushes—you'll soon see 'em—on the shelf—in some—museum."

Somewhere on some highway in fantasy there still exists a set of signs: "If you don't know—whose signs—these are—you can't have driven—very far." H&A